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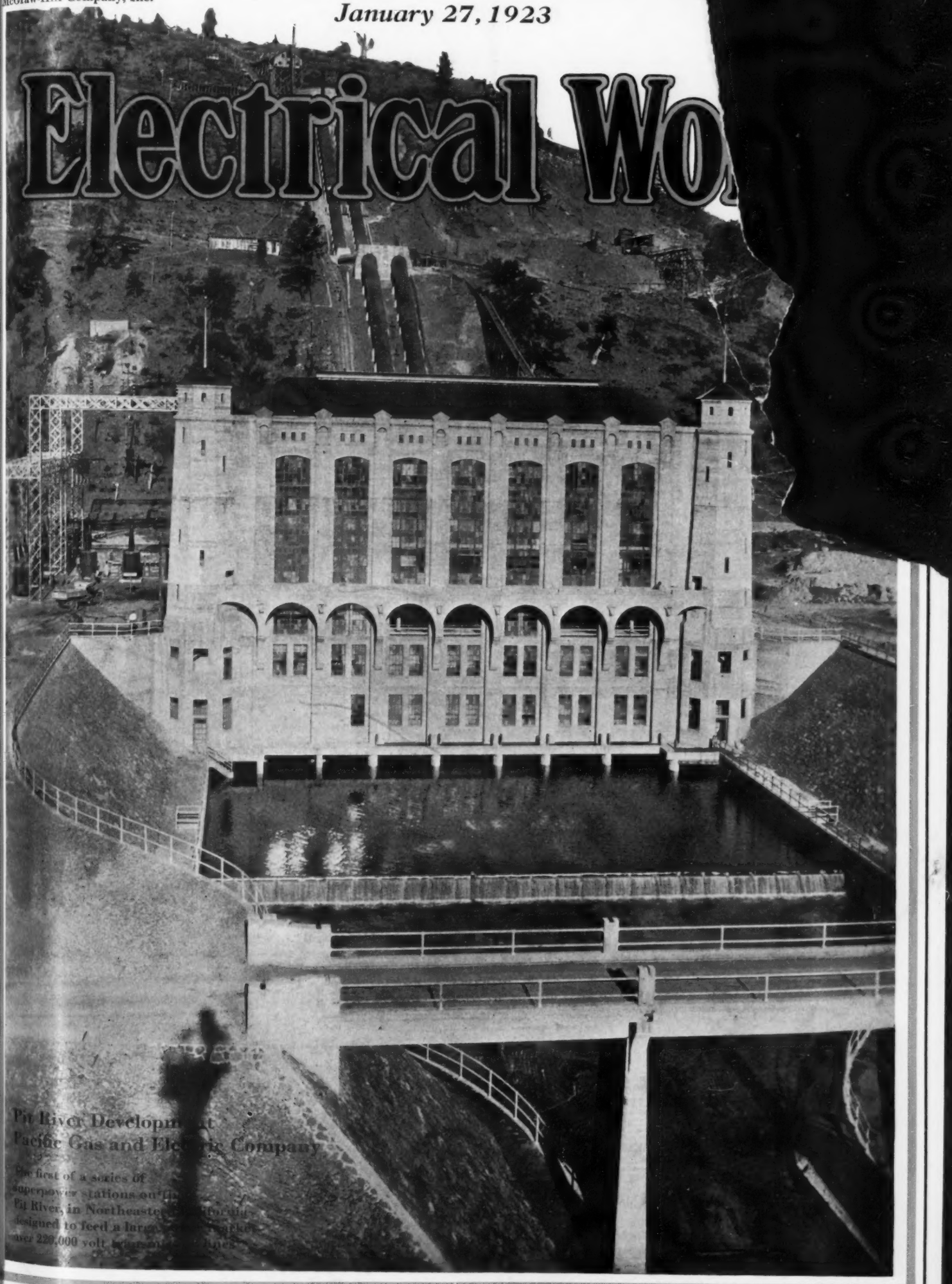
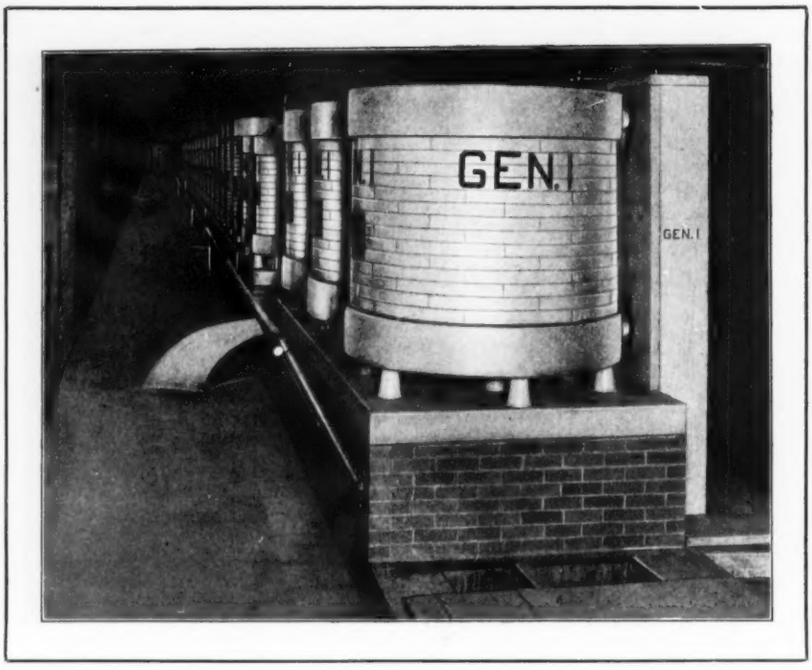
January 27, 1923

Electrical Wo

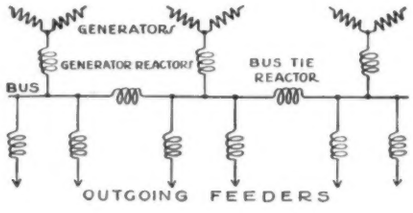


Pit River Development
Pacific Gas and Electric Company

The first of a series of superpower stations on the Pit River, in Northeastern California, designed to feed a large [illegible] over 220,000 volt transmission lines.



...New York Edison Co. has 100% Generator Protection



Four Super Power Plants Equipped With Metropolitan Reactors

The diagram above illustrates the protection afforded Waterside Station No. 2 of the New York Edison Co., by Metropolitan Reactors.

In super power plants, having installed and connected reactors from 20,000 to 40,000 KVA., the reactor efficiency is almost as important as their reliability. It is often worth while to evaluate the losses in dollars and see how much would be saved by installing the most efficient —the most economical reactors.

For full information on savings of this nature that can be effected, just clip the coupon.

Other Metropolitan Safety Devices

Service Switches
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Gentlemen:—Please send data and full information on current limiting reactors.

Name ..... Company .....

Address ..... Title .....

And kindly check any of the items at the left on which you desire information

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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What to Do

THE world is full of good advice. We are plenteously supplied with theorists and prophets willing and eager to point us all along the paths of progress. There are so many plans and purposes and opportunities before the face of every man interested in the development of the electrical industry that oftentimes there seems to be no sure place to begin.

With the whole wide world spread to his eyes and with the greatest service to render that has ever blessed mankind, the electrical man is often baffled with the question of "what to do." The time is short, the task is great and ambition urges to divergent ends.

Fundamentally there are four things to do, four ways to work that simplify the problem and help to set a course and get the work done. There are four principles around which the development of the electrical industry can well be organized:

1. Use the agencies now in the field. Employ the tools that are at hand. Continue the methods that experience has proved good until the work that they will do has been completed.

2. Follow the line of least resistance. Undertake first those things most possible. Concentrate on getting actually done that which will contribute each time the next advance in the purpose and the progress.

3. Proceed along national lines of thought that will take advantage of the interest and the inclination of the masses of the people. Carry forward step by step in the direction of the popular demand, guiding the industry in its growth, but not attempting to resist its natural trend, rather following and serving it.

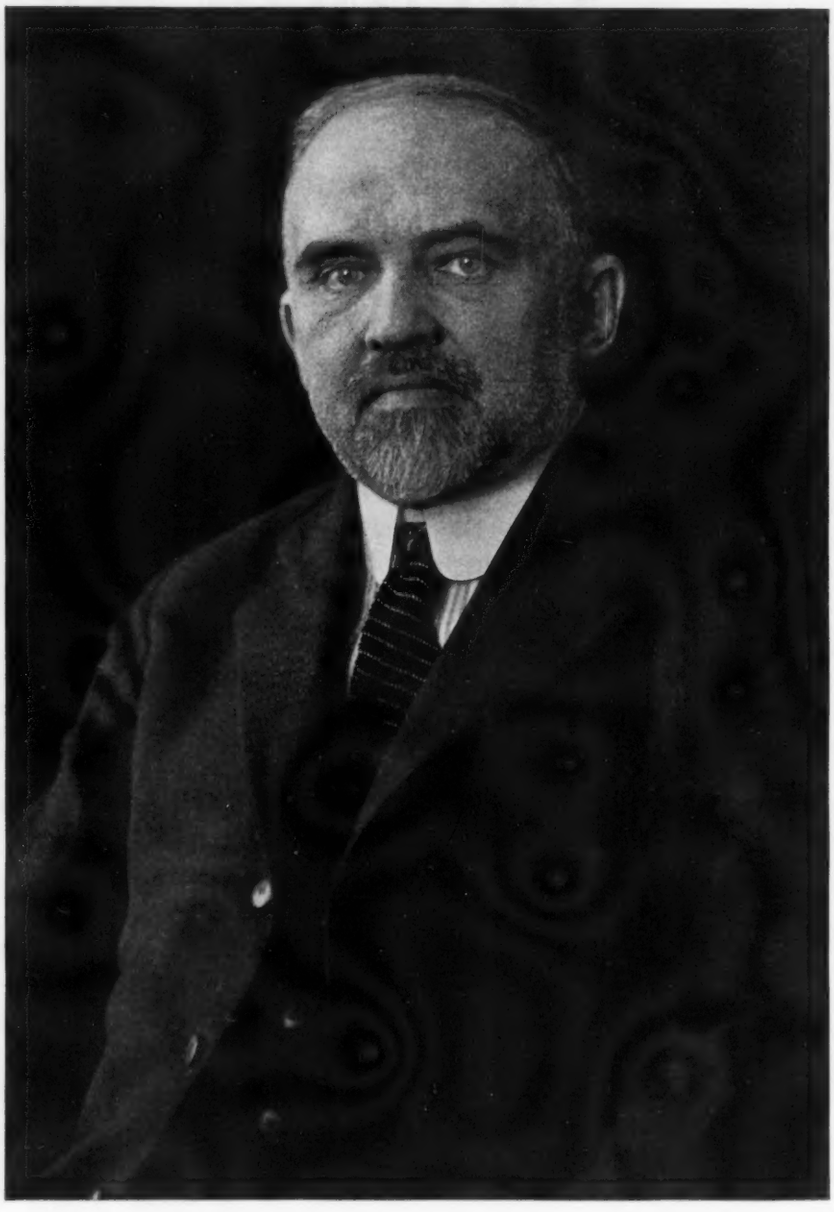
4. Apply the actual work as an individual and a local effort. Assume responsibility to do first all that can be done to prosper the next job. Make the little things done each day tie into the upbuilding of the electrical industry in the community as the prime consideration and the basis of all bigger plans.

IN the last forty years thirteen million customers for electric service have been connected to the lines of the central station. Not long ago three dollars income per capita in a community was considered good, but today a revenue of thirteen dollars per inhabitant is not uncommon. New consumers are taken on by the thousand in great selling drives. The project to electrify America is really not so big a job as it appears. It can be done. It has been already started.

But no plan, no policy alone will ever accomplish it. Whatever is achieved will be the product of the daily work of engineers, manufacturers, jobbers, central-station men, dealers and contractors who, supported by the co-operation of the entire industry, look to see what to do, each in his town, and then do it.

Walter Sherman Moody

A pioneer in power transformer design and a specialist in insulating and magnetic materials.



THE transformer and the induction motor are the two machine developments that have created the alternating-current electrical systems. The great networks of high-voltage transmission lines owe their existence to the development of the transformer, and Walter Sherman Moody stands in the same relation to this device that Nikola Tesla does to the induction motor.

Back in 1888, while an instructor at the Massachusetts Institute of Technology, Mr. Moody helped William Stanley demonstrate the Goulard and Gibbs alternating-current system. He was so greatly fascinated by its possibilities that he devoted his energies to this field of research. He was assistant engineer with the Thompson Electric Welding Company from 1888 to 1892 and then became a designing engineer with the Thomson-Houston Company at Lynn and became chief engineer of the transformer department of the General Electric Company when the merger occurred. While with the General Electric Company he has made notable contributions to the art, holding nearly fifty patents, and he was the originator of the circular-coil type of transformer with a core of approximately round cross-section. He also was the designer of the first "air-blast" transformers.

Today he is chief engineer of the transformer department of the Pittsfield works of the General Electric Company and has general supervision of transformer engineering at the Fort Wayne and Lynn plants. He has helped make possible a growth in transformer size and rating from the small figures of the early days to those of today, with ratings of 25,000 kva. and 220,000 volts.

Born in Chelsea, Mass., Sept. 20, 1864, Mr. Moody was graduated in the first electrical engineering class from the Massachusetts Institute of Technology in 1887. He taught in his Alma Mater for one year and then entered upon his career as a transformer engineer. Believing that he should know materials, he got into close touch with Sir Robert Hadfield in the development of silicon-steel alloys and co-operated with the Allegheny Steel Company in the first production of silicon-steel sheets. He also became a specialist on insulating materials and the metallurgy of iron and copper.

In the midst of his technical activity Mr. Moody found time to write many authoritative papers and to co-operate with the activities of other men in the industry. He is a fellow of the A. I. E. E., a member of the N. E. L. A. and the American Electrochemical Society. His social affiliations are with clubs in Schenectady and Pittsfield.

Editorial Comment

Electrical World, January 27, 1923

Volume 81 Number 4

Persecution by the News Reporter

WHY should the newspaper reporter prey upon the electrical industry? For instance, recently two persons were found dead in a bathroom. One body lay in the water, the other upon the floor. And this is what the news sleuth wrote—in his final paragraph:

> Coroner Blank thought it was improbable that the deaths were due to electrocution. Occasionally, he admitted, a person taking a bath gets a shock strong enough to kill if, while still in the water, he touches an electric light fixture. Death by electricity, however, generally marks its victim, even though the burn be a small one, and no such scars were to be found on either body.

Now, all were agreed that it was not "death by electrocution." All would have doubtless agreed that neither was it death by forest fire, cyclone, automobile collision or swallowing false teeth. But this the reporter does not speculate upon. By suggestion, however, he spreads abroad the hurtful thought that death by electrocution is not uncommon, though the coroner would not "admit" it in this case. All this is bad for the central-station company. It is bad for all electrical men—which in turn is bad for the newspaper. But the reporter does not think about this, and so he speculates about this tragedy and says, "It might have been electricity, but it wasn't." And the reason that he does not realize how he harms the electrical industry is because no electrical man has ever gone to the trouble to take him out to lunch and explain it all. For friendly personal contact with the men who write this local news will develop understanding.

Operating Code Makes for Permanent Economies

A PERMANENT operating code is an aid to economy in the operation of a central-station system. It reduces the harmful effect of the frequent changes in personnel that are sometimes unavoidable. Another advantage is that while highly paid engineering and executive talent can be used to formulate the code and to revise it at intervals, yet the operations favored can be carried out by men who, though lacking high technical knowledge, are better suited to handling the operating forces.

In the modern central-station system too frequently an able executive and engineer organizes various methods of procedure as he works his way to the front ranks, only to find later, upon studying his organization in detail, that his rules of operation have been changed by his successor to the detriment of the system. He often finds, too, that a change in a foremanship makes it necessary for him to supervise the new incumbent's work minutely in order to insure efficiency. With the grade of labor used in subordinate positions executive supervision over every detail is required. A written operating code helps greatly in improving these conditions, particularly if along with the code an educational plan is intelligently pursued.

As a practical matter it has been found very difficult to formulate such a code on a national basis, because the changing conditions in the art and the personal opinions of minor executives are difficult obstacles to overcome. None the less, a code offers many opportunities for putting the best methods of the industry into practice, and several companies have formulated codes for their own use and have proved their efficiency through trial. The ELECTRICAL WORLD in this issue starts the publication in the Central Station and Industrial Practice department of such a code. It hopes that a valuable discussion will follow on which a more universally applicable code can be based.

Advisory Publicity Council Deserves Support

THE announcement that the publicity council which has been serving as an active advisory board to the Society for Electrical Development will from now on function also for the Joint Committee for Business Development is a gratifying evidence of progress. This council is composed of a group of the directors of publicity of the principal electrical manufacturers and central-station companies. Through its association with the joint committee, also, it will become in effect an advisory publicity council for the industry and an instrument for assisting and harmonizing to some degree the many independent influences which the electrical industry is now exerting in various forms of advertising and publicity.

An interesting case, of recent report, offers a good example. A certain group of manufacturers has apparently decided to employ a publicity man to organize a joint campaign of publicity in the form of "human interest" articles written around their particular appliance, which will be broadcasted to the newspapers of the country, with the expectation that many will be printed and thereby advertise the product of the group. But it happens that for several years the Society for Electrical Development has maintained a press service to provide a well-balanced presentation of the story of electricity in the home and industry, written in popular form, and about 450 newspapers are accepting it as legitimate news and using it. Moreover, the state committees for public information, which have been organized through the efforts of the National Electric Light Association and the other national utility associations, are providing the press with an ample amount of current facts on public utilities, and their articles and items are widely accepted. For independent groups of manufacturers, therefore, to enter the arena and begin to deluge the press of the country with a flood of "news stories" which because of their more limited topic would necessarily smack of propaganda might shake the entire confidence of the press. The fact that news of electrical

developments and activities has become recognized as of vital interest to the public is a great achievement. The newspapers must not be provoked to alter their friendly attitude by any attempt to cram selfish "copy" down their throats.

The broader activity of this advisory publicity council should provide a responsible authority that may serve the industry well in guiding all its advertising efforts along constructive, helpful lines and avoiding wasteful duplication or hurtful mistakes. Its work should have the strongest possible support from all branches of the industry, so that their combined publicity may be synchronized as perfectly as possible.

Inductive Co-ordination and Public Duty

REAFFIRMATION by the Supreme Court of the State of Washington of its findings, rendered last fall, that the prior occupancy of a highway by telephone wires did not obligate a power company which had paralleled these wires by a properly constructed transmission system to bear the cost of metallicizing them again draws attention to the mutual obligations of utilities under such conditions toward each other and toward the public. In this case the power company had done everything that the present development of the art suggests to confine inductive influence to its proper channels, but the physical condition of the telephone system, which was grounded, made it unduly susceptible. The telephone system, the court clearly holds, had an equal duty to perform in putting its plant into a condition that would not place an undue burden on the power company and the public it serves. Despite the court's enunciation, in its second pronouncement—in order, it said, to quiet unnecessary alarm—of the obvious fact that its declaration that priority in time does not give a superior right to occupancy applied only to the case under review, the inference is that such priority has no effect on the obligations toward each other of the two classes of utility. In every case that arises these obligations must be determined by other facts than the mere question of which utility was first in carrying its service to the public over a highway which both have the right to occupy.

Financing Rural Extensions

FINANCING of rural line extensions has been a vexing problem all over the country because the revenue from most extensions of this character has been so small that they cannot be considered on the same basis as other classes of business. There have been almost as many extension policies in use as there are utilities in the field, and the confusion caused by the contradictory nature of the many policies has almost led many utility men to throw up their hands in despair. In a few cases the problem has been faced on a broad basis and an earnest attempt made to bring all the fundamental factors into consideration. One of these attempts is the study, extending over two years, made by the technical committee of the Northwest Electric Light and Power Association. The annuity plan of financing extensions as evolved by the committee is described elsewhere in this issue by R. M. Boykin, its chairman.

Without so stating, the committee starts with the assumption that commission regulation has put the returns from the operation of any given property on such a basis that the ratio of investment in certain items of property to the annual revenue is such as to provide a proper return to the utility. The utility under the suggested plan is then required to make investments for future consumers on this same ratio basis, and an annuity method of determining the advance payments to cover losses that must be borne by the consumer is applied to cover the remainder of the financing cost. The committee further assumes that the course of business development on any extension will be sufficient to place the extension on a paying basis in a reasonable period of time.

While these two assumptions are probably correct for Pacific Northwest conditions, they do not apply in some other sections of the United States, and for this reason the method suggested is probably not available for application over the whole country. However, it does represent an attempt to cover the fundamentals, and even though it may not cover all situations in its present form, it adds something toward the solution of the question and deserves serious study as one method of meeting the problem of financing not only rural extensions but other classes of extensions as well, particularly those in which the future development to a paying basis in the ordinary growth of a territory is an assured fact or at least as nearly so as anything of this nature can be.

Dominant Position of Anaconda Copper

AS THE largest user of copper in the world, the electrical industry has more than a passing interest in the purchase of the Chile Copper Company by the Anaconda Copper Mining Company. The combination will make the Anaconda company, which for almost forty years has been the country's greatest producer of red metal, the dominant figure in the copper markets of the world. With 16 per cent of the world's copper output to its credit, the company is in a position to make or break the copper market. If it shall become conscious of its strength as well as deeply sensible of its obligation, it can exercise the same sobering influence over the price of red metal that the United States Steel Corporation exercises over the price of iron and steel. The copper industry has long needed some such stabilizer among the half dozen or more great groups of copper producers.

That the Anaconda combination will have any effect in sending the price of copper downward is greatly to be doubted. Ever since the war the economic position of copper has been greatly unsettled. Overproduction was followed by shutdown and then by distribution of virgin metal and scrap from stock. Prices have been chaotic. If the enlarged Anaconda company shall prove to be nothing more than a stabilizer, it will justify itself. However, those who know John D. Ryan and Cornelius F. Kelley realize that the Anaconda will not be content to lead a passive existence. It has always been numbered among the enterprising companies of the country. It has linked itself with the electrical industry in more ways than one, and as goes that industry so will go the Anaconda. Its wagon is hitched too firmly to our star to lumber or to deviate from the path of progress.

A Practical Example of a Superpower System

THERE has been no little propaganda for the construction of superpower systems for the distribution of energy on a large scale along the Eastern seaboard. As Mark Twain once suggested with regard to the weather, "A great deal has been said about it but nothing done." Nothing, that is, has been done beyond preliminary studies and estimates for public consumption. As has happened many times before in power transmission matters, the Pacific Coast is on the job. Frank G. Baum's article on the Pit River power transmission system, of which the first part appears in this issue, describes a superpower network stretching more than 200 miles northward from its base load around San Francisco Bay. The operating voltage of 220,000 is now well within reach as a practical working pressure. From an engineering standpoint, therefore, the voltage is not surprising, although still impressive. Of far more interest to engineers at large are Mr. Baum's comments on the necessity which gave rise to this particular form of transmission on a large scale and the economic phase of what otherwise would seem an unusual project.

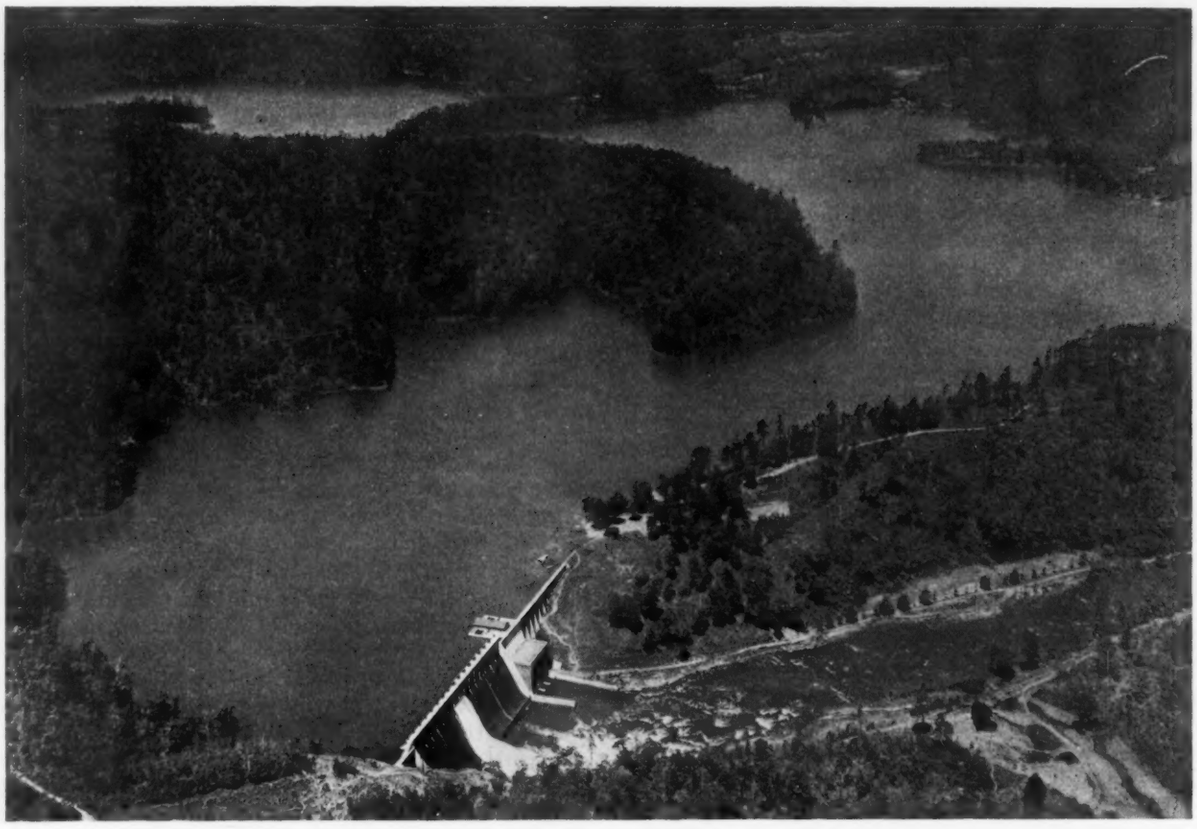
The point of the matter is that California as a whole is wonderfully well served with electrical energy. The networks in the southern, central and northern parts of the state are of remarkable extent and complication, so that more than 80 per cent of the population is actually served, a proportion much larger than that served in any other part of the country, especially the extreme East. The more electricity is used in everyday life the more call for it quickly comes, so that the situation which had to be met by the Pacific Gas & Electric Company was the provision for the San Francisco district of a very large amount of additional power which the existing networks could not supply. The water powers of California grow better and more reliable as one passes northward, and by far the best available source for great additional energy was to be found on the Pit River. The development here means 100,000 kw. at once and two or three times more in the near future. The striking novelty in this great long-distance project was not the addition of the Pit River powers to the existing network; it was rather the plan of boring through this network with a straight-away transmission line aimed to supply the rapidly growing power load around San Francisco Bay and to turn back the power from the widely ramifying networks to build up an intensive service of their own. In Mr. Baum's view, and he is unquestionably right, carrying out the project in this way means a great simplification, especially from the operating standpoint. The Pit River load is thus made independent and can be regulated as a whole without the complication of tying in with an already intricate network. The voltage on the long line can be dealt with by synchronous condensers of no very exaggerated size and held substantially constant at the load and irrespective of variations. Meanwhile it still remains possible to use in an emergency the existing network and the Pit River power to help out each the other's temporary deficiency, although this is not intended to be in the least degree the normal method of operation. Mr. Baum fully appreciates the importance of distributing power to all the communities of the state and criticises with a great deal of justice the timidity which endeavors to draw the load to the power instead of distributing the power to the load.

The transportation of electrical power is the least of the transportation problems which today confront industry. A new manufacturing center means new difficulties in the accumulation and distribution of material vastly more troublesome than any electrical distribution which might serve to place the plants in a better situation with regard to the transportation market as a whole. Further, it is undoubtedly desirable to check the extreme centralization of industry which is now going on. It would be much better to distribute the work over fifty towns and cities than to concentrate it in one of them, where, inevitably, high expense, a difficult labor situation and overcrowding with all its trail of misfortunes will hold sway. To be perfectly frank about it, a great industrial city is usually by no means a pleasant place in which to live, rarely well governed and almost universally overtaxed. In this civic sense the work of the distribution system which brings cheap power to the country in general, instead of confining it, as now too often happens, to a few big centers, is of primary importance, as Mr. Baum very pointedly shows. The interconnection which has gone on in California and elsewhere is, within its limitations, vastly efficient in providing general distribution at moderate expense, but when the time comes for a very large additional amount of power the Pit River plan exemplifies the best way of providing it to simplify the operating conditions. Of some of the other details of the project Mr. Baum will tell more next week. It is sufficient now to point out that the line involves no startling changes in practice, although the graded insulator string, of which the usefulness has been well proved, is a feature which does not appear sufficiently often on American lines. The Pit River system is certainly a most notable addition to the already great development on the Pacific Coast, and Mr. Baum's further studies, especially as regards the operating characteristics of the power plants themselves, will prove of much interest.

Build Up the Distribution System

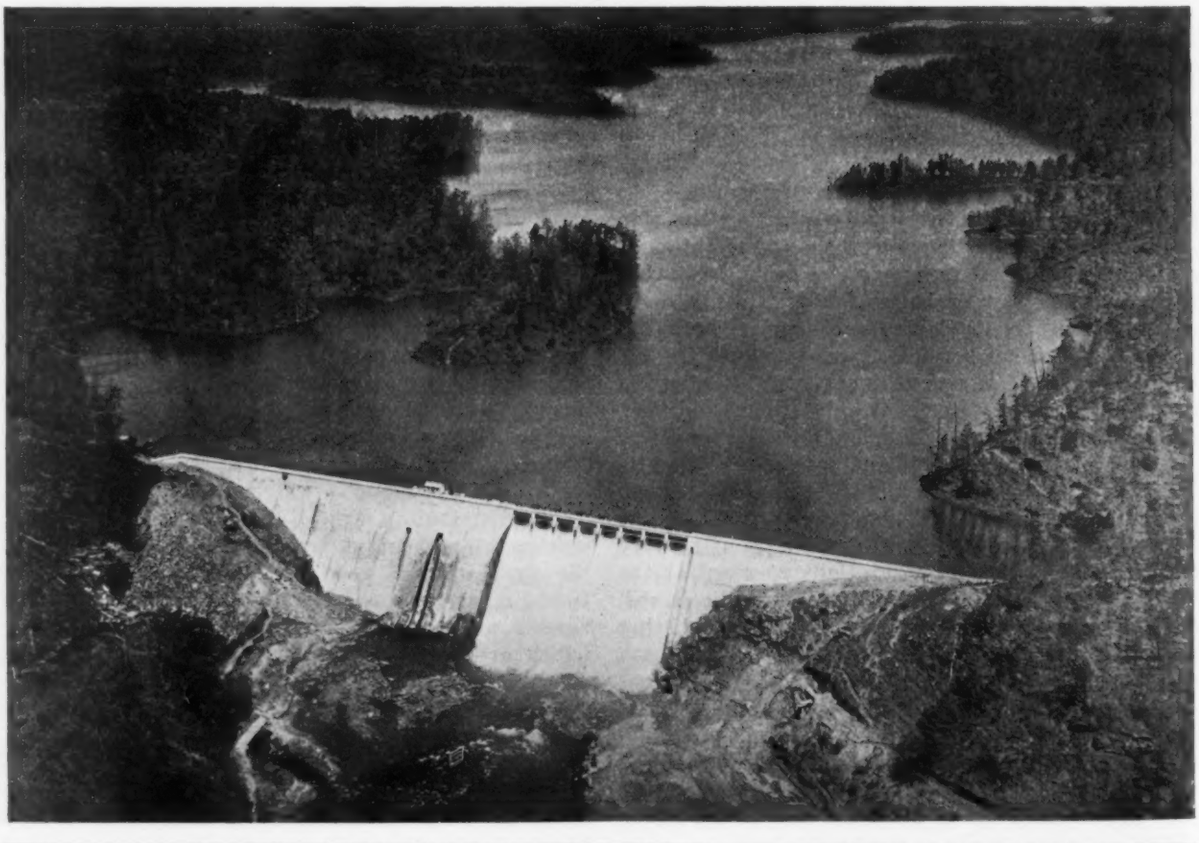
COMPLAINTS come sometimes from the distribution department that central-station executives do not appropriate money to it with the same readiness they show when the power-plant department is concerned. Many things may be to blame for this condition where it exists, but in many cases unfamiliarity with the distribution department's needs is the chief. Perhaps a little human vanity, easily pardonable, also plays its part; for almost every company takes great pride in constructing a fine generating station. Yet when monumental power houses involve, as too frequently they do, an expenditure for decorative and architectural effects out of all proportion to the condition of other parts of the system the error in judgment is manifest.

The distribution system is the one place today where maximum operating economies can be obtained through the application of good engineering and ample funds. In too many cases the existing distribution system represents an accumulation of historic systems many of which are obsolete, but whoever heard of junking a distribution system because of this? Another factor that calls for judicious expenditure is that the distribution system rapidly gets overloaded. Money spent in putting in reserve cable capacity and large ducts will be returned with interest as the system grows. Shoestring financing, on the other hand, is only pennywise. Ungrudging executive support should back the distribution engineers in their plans for development.



Georgia Railway & Power Company Develops Southern Water Powers

This company has already developed 150,600 hp. and upon completion of the Tugalo plant will have 234,000 hp. available from water power. Upper view, Mathis or Lakemont dam and lake. The reservoir stores 1,369,000,000 cu.ft. of water. Below is Burton lake and dam, which stores 5,280,000,000 cu.ft. of water.



The Pit River Power and 220,000-Volt Transmission Problem

PART I

Analysis of a California Power Problem Which Involved Transmission and Economic Questions of Unprecedented Magnitude and Pioneer Engineering of Noteworthy Character—Interconnection Not the Solution

By FRANK G. BAUM
Consulting Hydro-Electric Engineer, San Francisco, Cal.

THE chief merits of hydro-electric developments are that they tend (1) to stabilize rates for power uses and therefore to extend the use for electric power, (2) to equalize the rates for power as between the larger and smaller cities, so that the smaller towns and cities may build up industries, and (3) to conserve coal, oil and labor needed for other industries.

Many of the earlier water-power developments were not a success because they were developed for a lighting business rather than for a power business. It is the power load that has made a financial success of water-power developments and electric transmission, and in California we have many communities which owe their beginning and progress largely to hydro-electric power and transmission. Electric service and rates in California for given classes of service are practically the same in cities of 5,000, 50,000 and 500,000 population. I believe the real solution of the power problem must keep this fundamental of practically universal service throughout in mind. Electric service is too popular now to make it possible to deny the use of this service to a large proportion of the people or to have the cost so high in the smaller cities that the growth of the nation must take place in the larger cities.

I believe the recent overshadowing defeat of the proposed initiative constitutional amendment in California to turn the hydro-electric developments of the future over to the state was primarily due to the fact that electric service in California is almost universal. A secondary reason was the customer ownership, but the service to the customers was first necessary to develop the customer ownership. The problem is political as well as economical, but fortunately the best solution which gives stabilization of rates and wide service is also the best solution for the industry and nation.

Natural Conditions in California Plus Great Individual Initiative Have Resulted in the Development of Large Power Transmission Systems

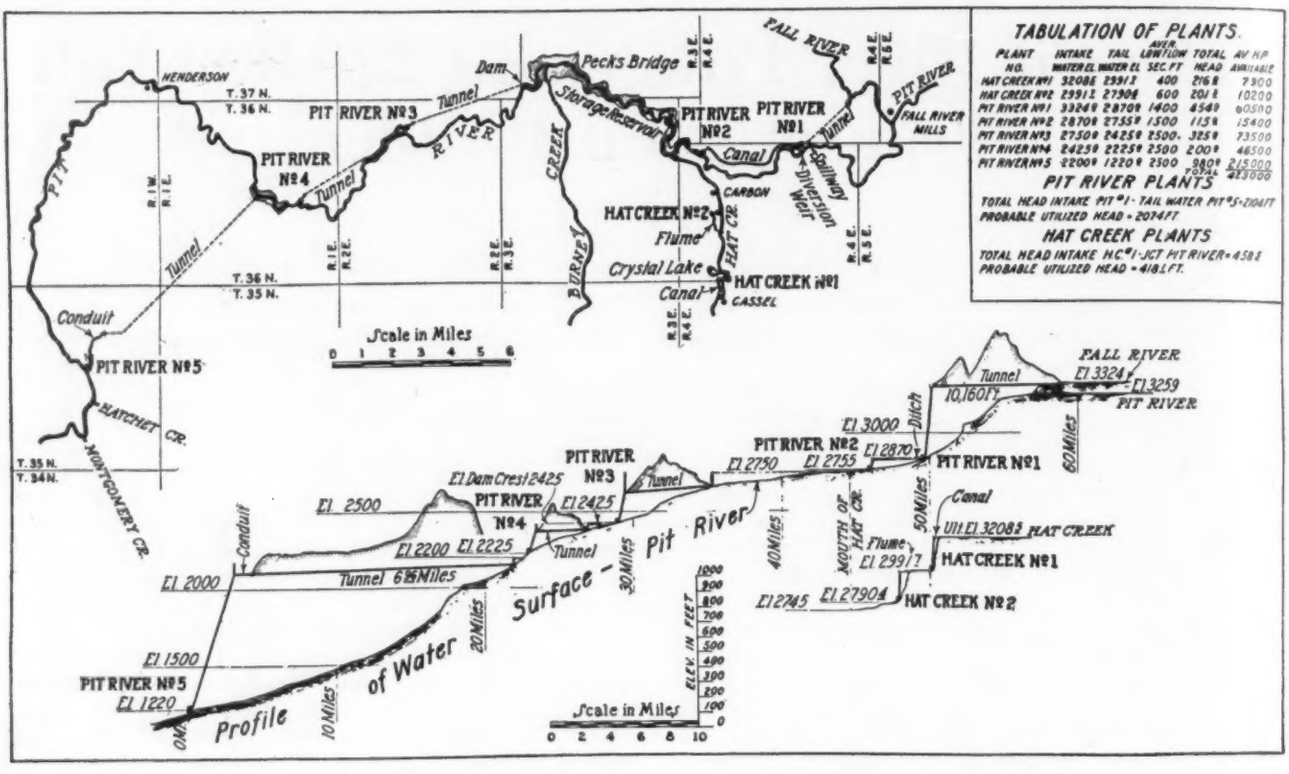
THE writer of this article has been connected with water-power and electric transmission developments in California since 1898 and has devoted his entire time and thought to this industry. He believes that what has taken place in California is a result of natural conditions plus strong individual initiative, which have resulted in a great advantage to the industry. The natural condition in California is that the water power is in the mountains east of the great interior valleys, and in order to bring the power to the large industrial centers near the seacoast the power transmission lines had to cross these valleys. Naturally there was developed along the transmission lines power business for mines, cities, industries, farms, etc., and this has resulted to the great advantage of the state as well as the power industry.

The following analysis of results attained in California was written by the author of this article in 1914 ("The Economic Value of Electric Transmission," Technical Publishing Company, San Francisco). Results today show that the economic value of electric transmission is proving the statements very conservative:

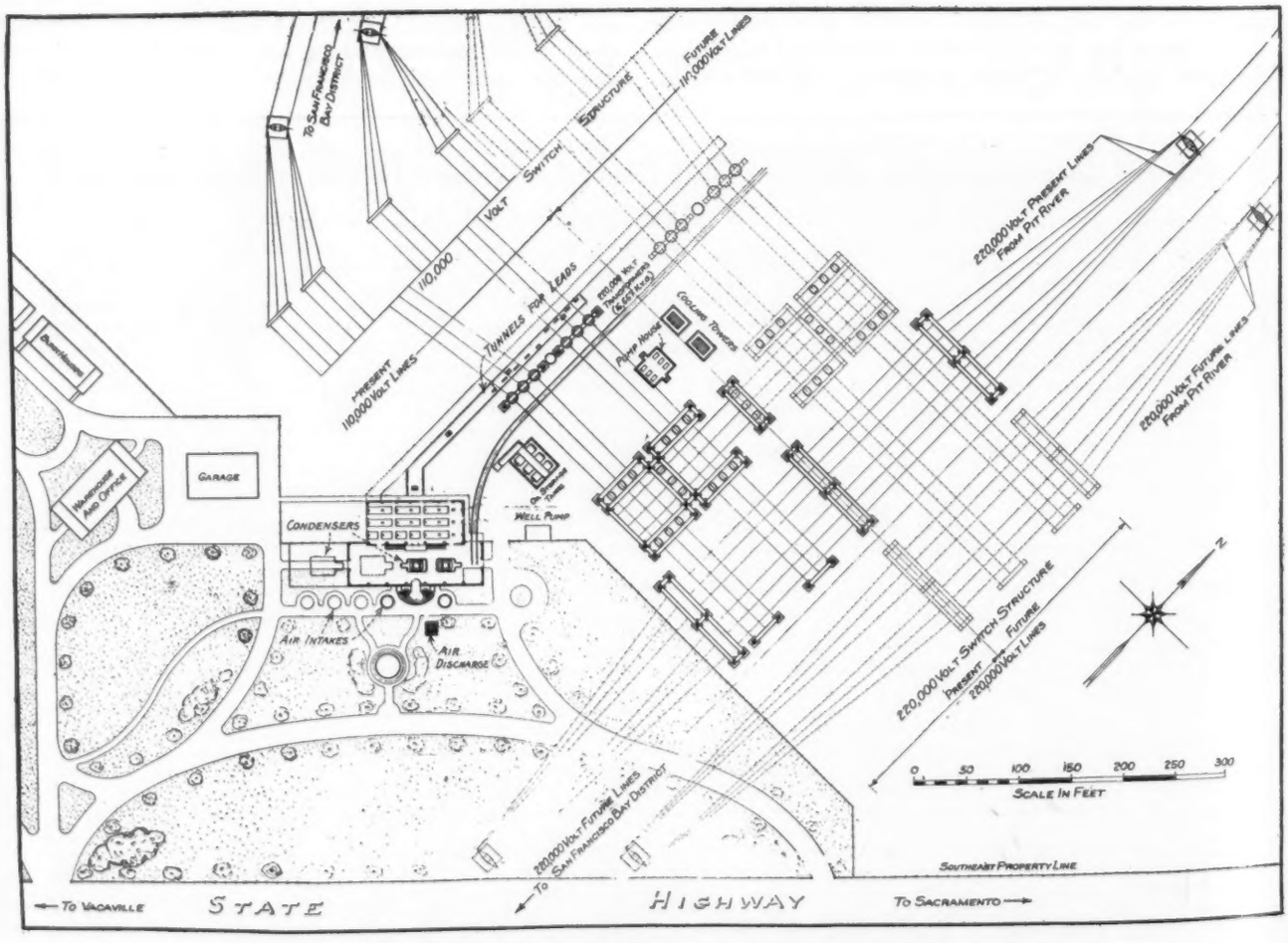
"The men who built the first electric power transmission systems in California did not realize how rapidly and to what magnitude the business would grow; yet, in a general way, they did appreciate the great advantages to be gained by a transmission system furnishing power to operate various industries from large, efficient power plants, instead of each industry supplying its own power from a small, inefficient plant. The economy to the consumer in any particular case could, of course, be determined and the saving to the power user effectively shown, but as the power transmission lines operating as a unit have become larger and made to cover more and more territory, the additional advantages of having large power systems supported by a varied series of industries have added additional economy and stability to the large systems and have also added general benefits to the industries and communities. The total result gives strong reasons for the increase of the electric transmission systems to cover generally a wider territory and more diversified industries.

"The result of such a system covering a wide area is that the same service in electric power is available at the mining camps in the mountains and to the small towns and industries in the central part of California as is supplied to the larger cities. Aside from the economies of such a system resulting from the 'banking' of the facilities, the power conditions throughout this area tend to become equalized, resulting in a distribution of population and industries not otherwise possible, and resulting, also, in adding to the general stability of the country and in great saving in capital and operating expenditures for the industries and cities served. Very often it enables the establishment of an industry—for example, a small factory, a rock quarry, a cement plant, a farm—at a point otherwise prohibited, adding to the economic value of the district.

"In consequence of this electrical development industries are being established in many of the smaller towns and outlying districts where the employees can live more advantageously, and the natural effective result is a healthy growth of all parts of the state, a large saving in operating expenses, capital and resources, a general equalizing of opportunities, and, on the whole, a tremendous economic gain for the communities, increasing in geometric ratio. It is naturally to the interests of the people that the power systems be extended as rapidly as conditions warrant, as the resultant economies from the extension of the business will of necessity redound to their benefit. For this reason, as I said before, California, or any state or nation having available cheap power, need never fear decay."



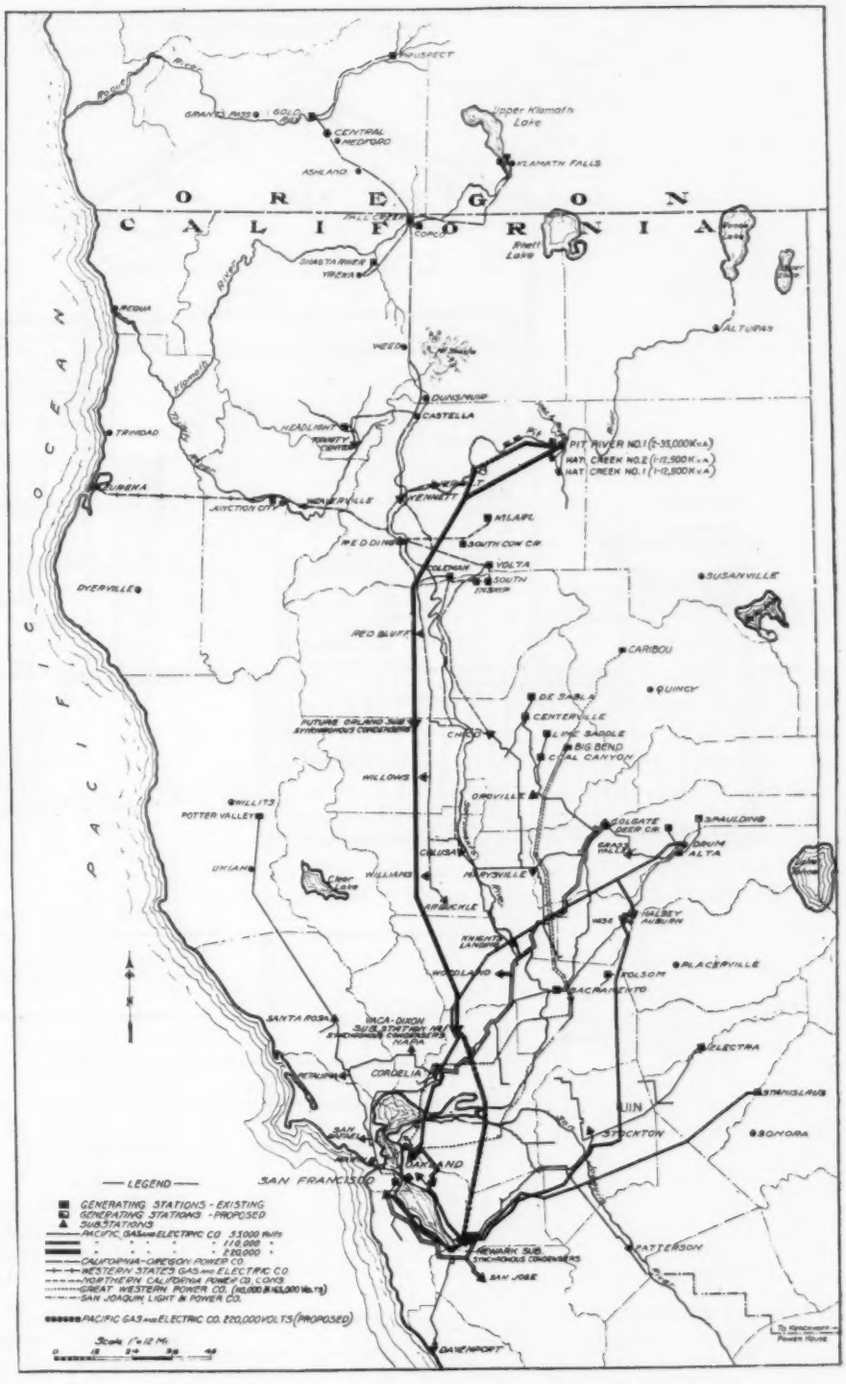
PLAN AND PROFILE OF THE CONTEMPLATED 400,000-KVA. DEVELOPMENT ON PIT RIVER



AT THE VACA SUBSTATION THE INCOMING PIT RIVER POWER IS TRANSFORMED, SWITCHED AND DISTRIBUTED TO THE SAN FRANCISCO BAY DISTRICT

With more than 80 per cent of the people of California enjoying electric service, there is little to fear from socialistic ownership schemes; but in many Eastern states less than one-half the people have electric service, and the smaller towns and cities have no real power service to help build up their industries, and I think the danger from this situation is serious. Electric men therefore have a responsible part to play in the future distribution of population of industries, on which depends the stability of the country as a whole as well as the stability of the power industry.

The power streams of California improve generally as one goes north, and gradually, as predicted years ago, the transmission lines have tended to be built from north to south. We required a large, dependable power supply, and Pit River gave us what was necessary, even though an extra hundred miles of transmission line was added. It will be noted that the Pit River power is farthest north, and that this power is taken through to serve the San Francisco Bay district loads, 200 to 300 miles away, without displacing the power step by step from north to south, as might at first glance seem to be the solution of the problem. Before entering into a description of the plants and transmission system the underlying reasons for the design and construction of the system will be given.

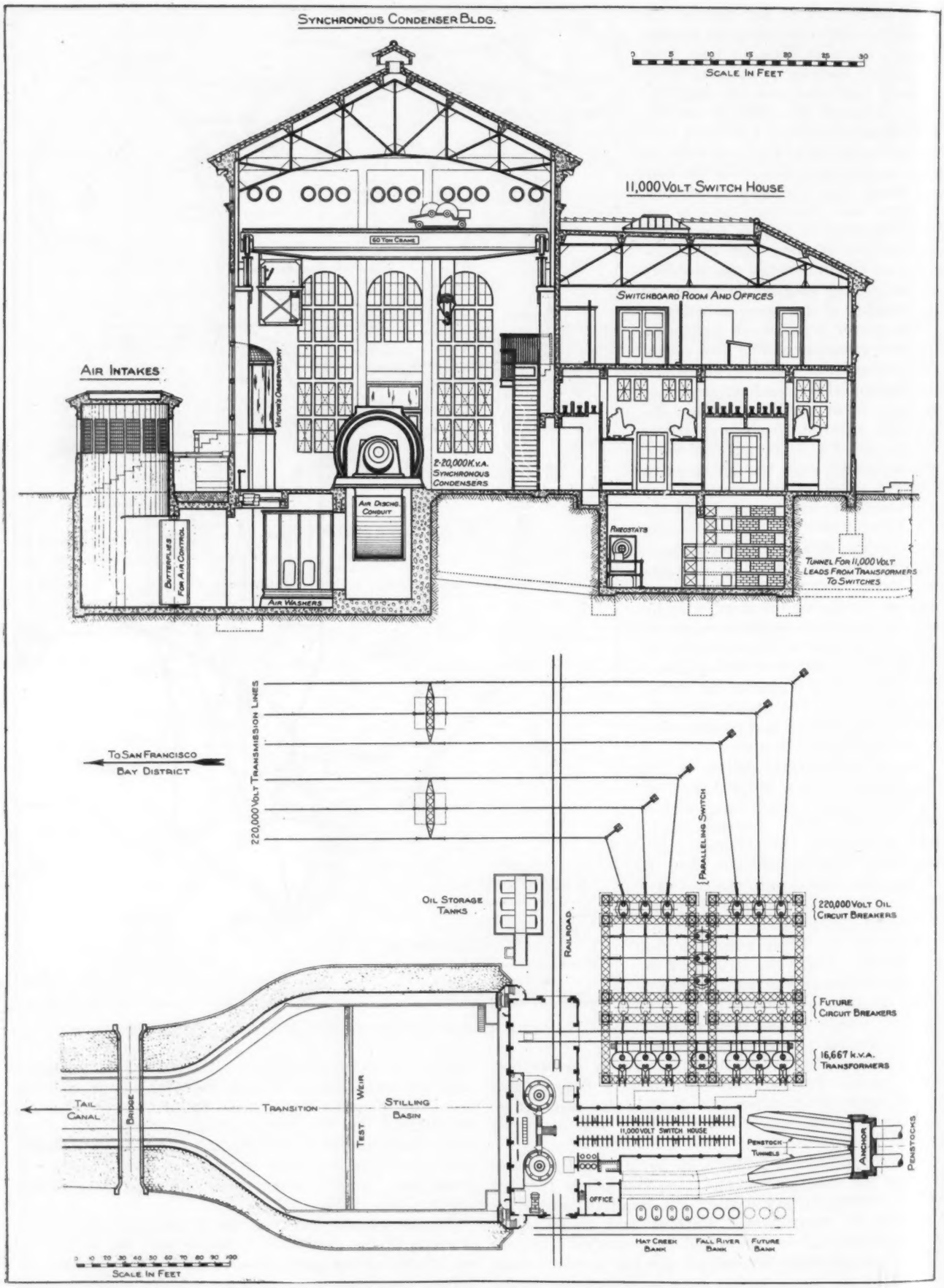


A CALIFORNIA SUPERPOWER SYSTEM WITH A 220,000-VOLT LINE

It was necessary to deliver to the bay district about 100,000 kw. at once and another 100,000 kw. within three to five years. Instead, therefore, of using the old and smaller developments and transmission lines to deliver their power into the bay district and have the Pit power displace the valley district loads, we decided to take the Pit River power to the bay district, where the large load is more concentrated and is more nearly of the magnitude of the power supply. In other words, it was thought best to join the big power supply to the large demand by a transmission system proportionately large. Further, we have now a future base power supply that solves our problem for some time. There will be ultimately about 400,000 kva. developed on the Pit River.

To have solved the problem by having the Pit power displace the valley power and have this power then go to San Francisco Bay would have required the reconstruction of many power stations and transmission lines and substations and would have created a system difficult to operate. By taking the big power supply directly to the large market by a large-capacity transmission system the problem became merely one of building a new large system complete. We thus tie up units of supply and transmission to loads that are commensurate. It required courage on the part of the engineers and the financiers to attack the problem in this big way, for it required the expenditure of approximately $20,000,000 for the power system, transmission lines and substations to deliver the first power to the 110,000-volt and 55,000-volt lines on the west side of San Francisco Bay. Only a large power system can do things on this large scale.

If the problem had been the development and transmission of say 25,000 kw. to 50,000 kw., the old method of displacing the power generated at one place for the power generated in an adjacent district might possibly have been used. For comparison, if we were to raise a few truck loads of potatoes in the Pit River region, we would transport them to Redding or Red Bluff, and



SUBSTATION BUILDING AND LAYOUT OF MAIN PLANT

A large switch house and synchronous condenser building at Vaca substation is shown in the upper view. The lower view gives a plan of the Pit No. 1 development with connections through outdoor transformers to the 220,000-volt lines.

the Redding or Red Bluff potatoes would displace those raised near Chico, and those would replace an equivalent amount near Sacramento, and finally the surplus would reach the large San Francisco market. But if we were to raise 1,000 carloads of potatoes in the Pit River region, then the right disposition is to take the large surplus supply direct to the large market.

It is believed that the solution of this power problem, which required for economy 220,000-volt design and transmission construction, will be followed by many similar enterprises in the United States of America in the next few years. For the power problems have become of such magnitude, owing to the large single power units and stations and the large markets, coupled with the high prices of coal, that the question of the transmission system must be attacked in a proportionately big way, if the electric power industry is to meet the needs of the times.

We could not expect the old county and city roads that made possible a speed of about 10 miles an hour and loads of 1 ton or 2 tons to meet the needs of present-day automobile traffic. Roads allowing a speed of 40 miles an hour and loads of 5 tons are required. Connecting up the old-fashioned roads would not have given a national or state highway system that would meet present-day needs. A new system of highways had to be designed and built to meet the new requirements.

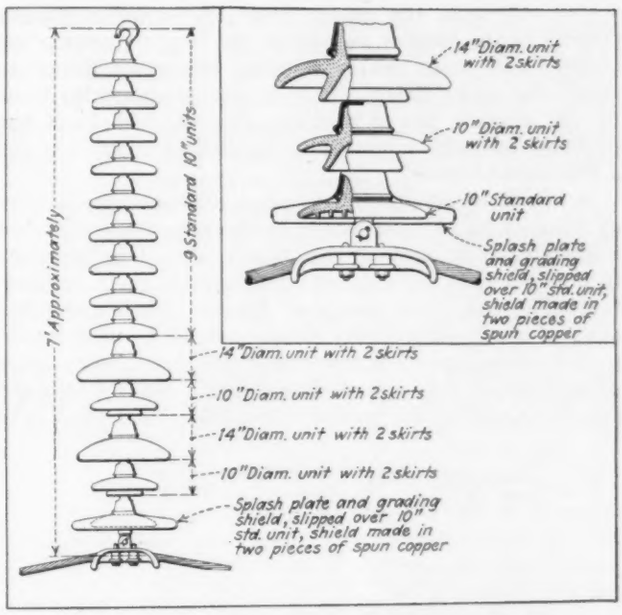
INTERCONNECTION NOT THE SOLUTION

Similarly, interconnecting the small-capacity power lines built out from various points for local uses will not generally give a transmission system to meet the needs of the electric power industry. We need large high-power transmission lines that will carry the power from places where there is little demand, like the St. Lawrence, the Niagara, the Southern Appalachians, the Rocky Mountains, etc., to places of large demand, and the transmission system capacity must be commensurate with the power available at these sources and commensurate with the needs in the large industrial regions.

Without the automobile and truck there would be no need of the modern highway system, and similarly without the development of the large steam and hydraulic power units and without the big markets, there would be no need for the high-power transmission systems we must have. Without a feasible power transmission system the problem could not be solved, but with a transmission system laid out on a big scale* so that we may transmit say 100,000 kw. to 150,000 kw. per circuit and 200,000 to 300,000 kw. per tower line, we have a solution of the transmission problem commensurate with the wonderful development of the water-power and steam units in the past few years and commensurate with the needs of the large markets in the Eastern States. Electric power units are now generally of 20,000 kw. to 60,000 kw. capacity and 75,000-kw. units will be in use in a few years. Single power stations of 100,000 kw. to 500,000 kw. are now being constructed. The power-transmission circuits must of course have capacities commensurate.

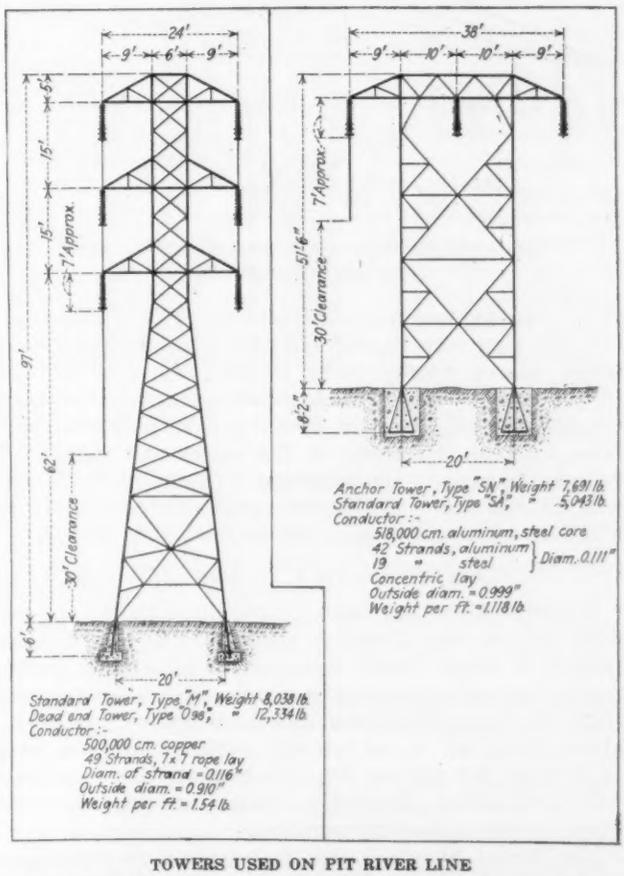
To attempt to find a local demand for the whole of these large powers, as was done at Niagara, because in the early days of the electrical industry there were no transmission systems developed, is uneconomic and unsound for the industry and from a standpoint of

*See "Voltage Regulation and Insulation for Large-Power Long-Distance Transmission Systems," by F. G. Baum, *Transactions A. I. E. E.*, June, 1921, pages 643-648.


14"Diam. unit with 2skirts
10"Diam. unit with 2 skirts
10"Standard unit
Splash plate and grading shield, slipped over 10" Std. unit, shield made in two pieces of spun copper
7' Approximately
9 Standard 10" units
14"Diam. unit with 2 skirts
10"Diam. unit with 2skirts
14"Diam. unit with 2 skirts
10"Diam. unit with 2 skirts
Splash plate and grading shield, slipped over 10" std. unit, shield made in two pieces of spun copper

DETAILS OF INSULATORS USED ON PIT RIVER LINE

national stability. For to be stable we should have the industries of the country diversified and spread out over the country as much as possible, building up the smaller communities as well as the large centers. At present places like Niagara, New York City, Boston, Philadelphia, Chicago and other places have much cheaper power than obtains in the smaller cities and towns. This does not make for a healthy growth of the states and nation. We need a transmission system

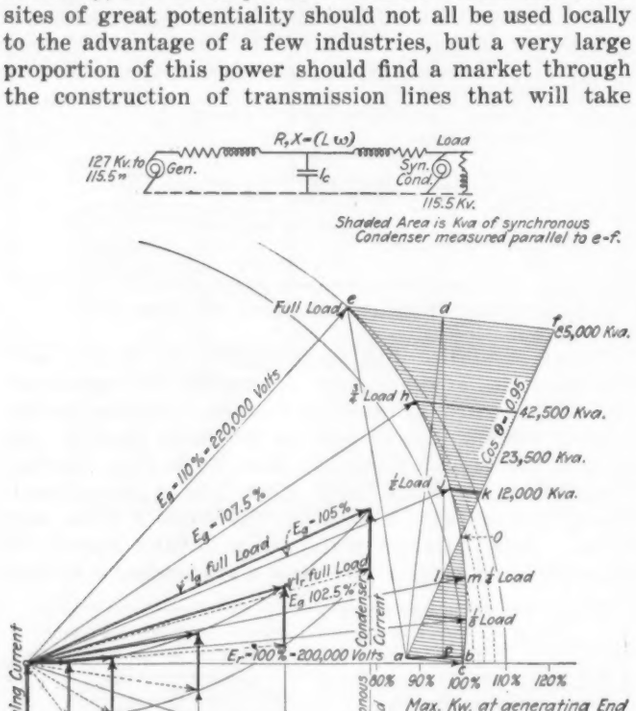


TOWERS USED ON PIT RIVER LINE

Left—Main-line double-circuit towers, used in valleys. Right—Towers used in the mountains, where snow and ice make vertical spacing inadvisable.

which will take the power from the large producing centers to the smaller as well as the larger consumption centers and more nearly equalize power conditions in small and large cities. That is the fundamental basis of the electric power problem and on that basis the problem has been successfully handled in California and a few other states.

It is not sound practice to allow all the water powers of Niagara to be used locally to the advantage of a few industries, but part of this power should be required to flow out into the smaller cities to help them prosper. Similarly, the water power of Muscle Shoals and other sites of great potentiality should not all be used locally to the advantage of a few industries, but a very large proportion of this power should find a market through the construction of transmission lines that will take



THE SYNCHRONOUS CONDENSER IS USED TO GET GOOD LINE REGULATION

it to available markets and build up present communities. In that way we will spread out the advantages of water power among more people, and this will in turn create a more favorable public opinion for the logical development of water power and transmission systems to meet the needs of the states and nation. I believe the men in the electrical industry in California will see the logic of the reasoning now that there is available a transmission system with which to back it up.

PIT RIVER 220,000-VOLT TRANSMISSION LINE

Recently there has been completed in California the first step of what I believe confidently to be the forerunner of many similar systems covering large power producing and consuming regions, and I believe an account of this achievement and the reasons therefor, as above given, will be of interest to the industry as well as to those far-sighted financial men and business men who have ability and vision, energy and courage combined in the proper proportions.

The Mount Shasta Power Corporation (a subsidiary of the Pacific Gas & Electric Company of California) has completed the first step of a series of power developments on the Pit River, which is in the northeastern part of California, and has constructed a transmission line to the San Francisco Bay region. The first power development consists of two stations of 12,500 kva. each and one station containing two units of 35,000 kva. each, making a total of 95,000 kva., with step-up transformers for 220,000-volt delivery to a transmission line 202 miles in length and to the first substation. This substation contains 100,000 kva. in transformers, which lower the voltage to 110,000 for secondary transmission and to 55,000 for primary distribution to the San Francisco Bay district.†

The power load of the bay district first justified (about 1898-1900) the construction of plants of about 10,000 kw. easterly and northeasterly from the bay. The Standard Electric Company's network was first designed for 60,000 volts, 60 cycles, and a grounded system. This system was also adopted by the Bay Counties Power Company. The two systems formed the nucleus for the present network of the Pacific Gas & Electric Company. I have always advocated 60 cycles and a grounded system, believing that this should become standard for the United States. I believe the grounded system necessary for any large high-voltage system.

As already stated, the construction of the transmission lines across the Sacramento Valley developed considerable power business outside the bay districts. At the present time practically all power used in this section is electric power, and this great diversity has resulted in a high load factor for the system and has also greatly stabilized the earnings of the Pacific Gas & Electric Company.

San Francisco and Oakland, the larger cities in the bay district, justify steam plants for local insurance, as well as to give an economical proportion of steam and hydro-electric power as determined by the load curve of the system.

The growth of the system, as is generally known, has been very rapid, and this growth has been in the valley cities as well as the larger cities, owing to the policy of the company and the natural conditions in the territory, as explained above. The Pacific Gas & Electric system now has a daily load of about 200,000 kw. average and a peak load of about 275,000 kw., giving a very high load factor. About forty different power plants supply power to the system, which consists of several thousand miles of transmission lines. This growth has occurred in about twenty years.‡

LINE REGULATION

In a second article the Pit River power plants will be described. The transmission line designed for 220,000-volt operation is the only part of this development which is pioneer work.‖ Manufacturers have been ready for some time to furnish transformers and switches for 220-kv. service, as well as generators and turbines of the rating required for this voltage. Therefore our studies were concentrated largely on the problems of line regulation and insulation. The line regulation we consider solved with the help of synchronous condensers, without which operation at this voltage would be

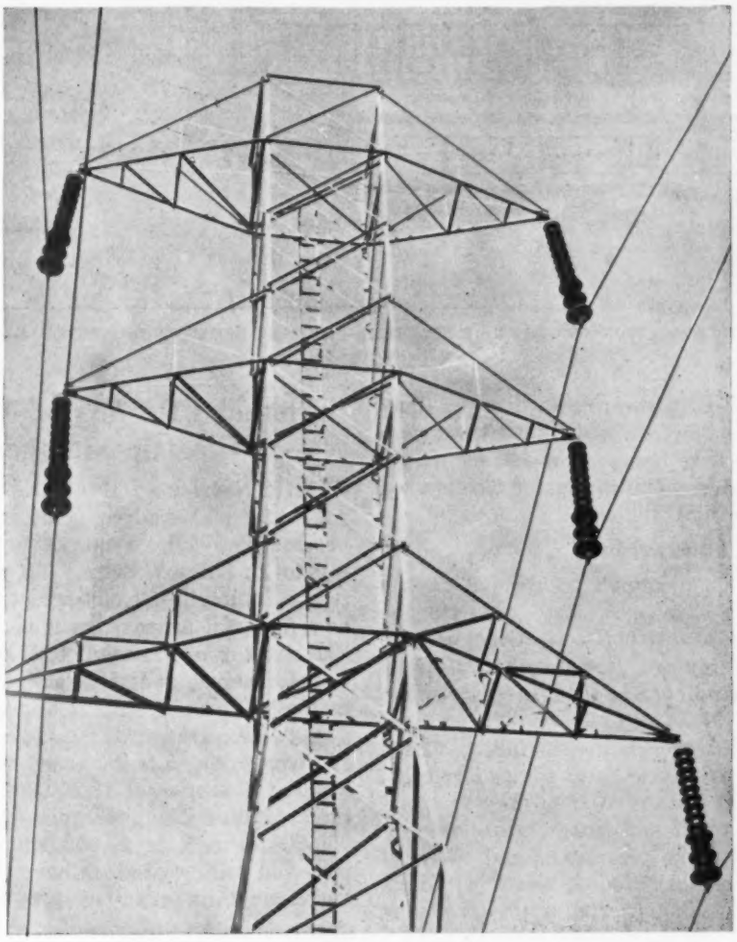
†See "Rebuilding a Transmission System," by J. P. Jellyman, ELECTRICAL WORLD, Sept. 16, 1922.

‡See "Progress of Power Industry in Far West," by F. G. Baum ELECTRICAL WORLD, May 22, 1920, and "Potential Water Power in California," by F. G. Baum, *Pacific Service Magazine*, July, 1920.

‖See "Voltage Regulation and Insulation for Large-Power Long-Distance Transmission Systems," by F. G. Baum, *Transactions A. I. E. E.*, June, 1921, pages 643-648.

impracticable. A description of the transmission line, which was so designed that we shall get (1) a stable line, (2) a constant-voltage line and (3) a reversible line was contained in the paper above referred to and will be only briefly alluded to here. (Interesting articles on the 220-kv. line, discussing the use of distributed condensers for stabilization and regulation of potential, have been written by F. W. Peek, Jr., *Transactions A. S. C. E.*, November, 1922, and Prof. A. J. Ryan, *Transactions A. S. C. E.*, December, 1922.)

On long lines at high voltages the charging current at no load, being a leading quadrature current, causes a voltage rise over the line when flowing over the reactances found in its circuit. At heavy loads the power current causes a voltage drop flowing over resistances and reactances in the circuit. Thus, by introducing at no load a lagging quadrature current, voltage rises may be compensated for, and by introducing at heavy load a leading quadrature current, voltage drops may be compensated for. This the synchronous condenser will do, so that it becomes in effect a variable reactor at excitation below normal and a variable condenser at excitation above normal. Two condensers each of 20,000 kva. capacity at leading quadrature current, giving 12,000 kva. at lagging quadrature current, are installed at the Vaca substation at the end of the line. This station has room for an additional condenser of 40,000 kva., which will become necessary when the load grows. Condensers will be added at the center of line when required for regulation and stabilization of potential under operation at 220,000 volts.



A GREAT AMOUNT OF RESEARCH WAS REQUIRED TO DEVELOP THE GRADED INSULATORS FOR THE 220,000-VOLT LINE

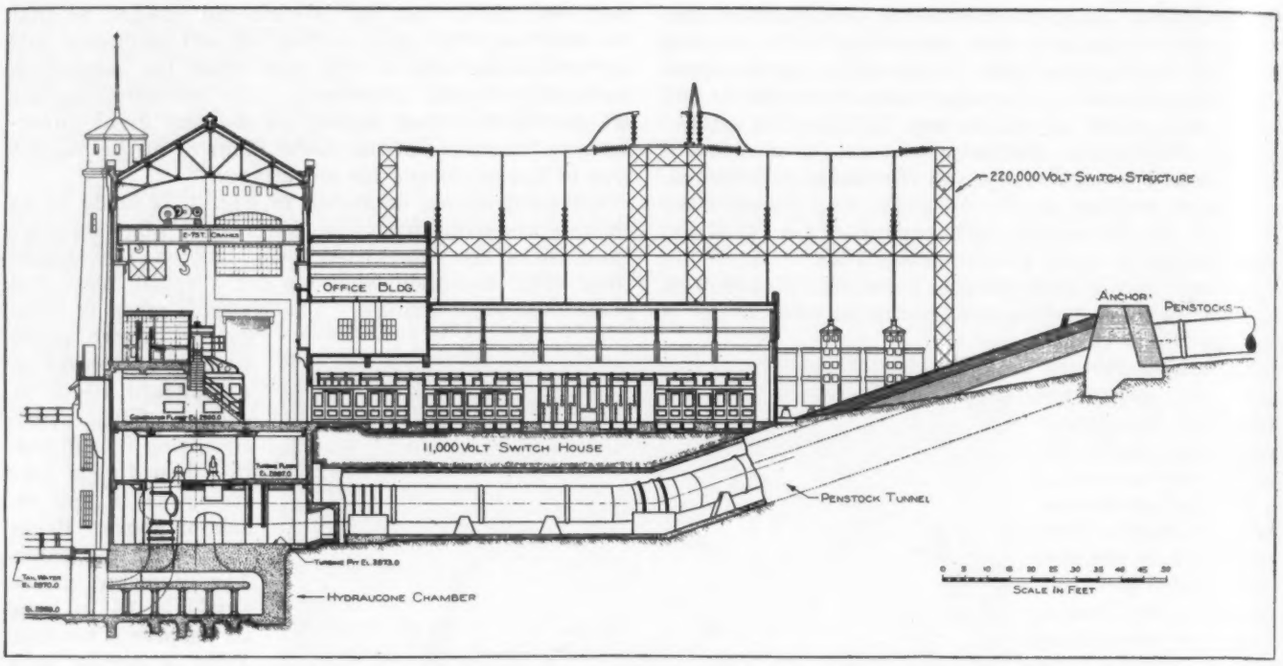
LINE INSULATION

The line insulation was studied extensively in the various laboratories of the country, as described in the 1921 A. I. E. E. transmission paper referred to. A discussion of the reasons pro and con for the selection of the string of insulator arrangements used would lead too far for the present article. Suffice it to say that the chosen string is not considered the final solution in the insulation for high voltages, although we expect better operation at 220 kv. with the arrangement referred to than is now obtained on 110-kv. lines. It will be necessary to study the problem continuously not alone for 220 kv. but for 100 kv. and upward, so that we shall not fall into a state of self-assurance and neglect the matters, as was done when the suspension insulator first was introduced. All interested parties are now alert as they appreciate the very great importance to the future of the power industry of the highest type of line insulation for all voltages.

A typical string, as shown in Fig. 3, is made up as follows, counting from the tower arm nine standard 10-in. disks, one two-skirted 14-in. disk, one two-skirted 10-in. disk, and then what we call a splash plate and grading shield combined. The latter is made of spun copper in two pieces which are slipped over a standard 10-in. insulator unit, short-circuiting it, and suspended from the string as is any insulator above. Below this is the line clamp. The diameter of the shield is 16 in., and its purpose is twofold. First it serves as a splash plate during a rain with heavy drops and brings about on the unit next above it a surface condition similar to that which exists on all the rest of the units. Without it the undersurface of the last unit would be dryer than that of any other, piling up the voltage on it. Second, it assists in a better voltage distribution between the units by control of the capacity currents. The assembly gives a string length of about 7 ft. Voltages of the order of magnitude of 500,000 are necessary to flash over such a string. Experiments bearing on the problem are still going on, but briefly the writer may say he is convinced that the solution of the insulator problem for 220-kv. operation requires:

1. A long string of insulators, so that birds, etc., will not cause short-circuits.
2. A string containing five to seven units, so as to give good natural potential distribution, reducing the shield to small proportions.
3. The surfaces to be of such design that the maximum discontinuity of water streams caused by rain, dew or fog will result.
4. Each unit to be designed for good potential distribution under wet and dry conditions.

The construction of the second Pit River line was not completed over the mountain section before winter set in. The lines are therefore operating at 125,000 volts. This is to be raised later to 175,000 and then to 220,000.



VERTICAL SECTION OF PLANT AT PIT RIVER, SHOWING LOCATION OF SWITCH HOUSES AND MAIN UNITS

The main-line double-circuit towers shown in the illustration were used in the valley, while double towers were used in the mountains, where heavy snow and ice makes vertical spacing inadvisable. The conductor cables used are shown in tower drawings.

VACA SUBSTATION

The Vaca substation is designed to receive at the present time all the Pit River power, to regulate the voltage and to distribute at 110,000 volts the power to the San Francisco Bay region. Later other stations will be erected as required. (See plan of station, on page 206.

Two banks of 50,000 kva. each are installed. They are auto-transformers, two-to-one ratio for full voltage. There is a tap at 165,000 volts, and they may be operated at 110,000 volts without auto-transformation.

The synchronous condensers are started and operated from tertiary and quarternary deltas, these windings also transforming and absorbing the triple-frequency exciting current.

To a great extent the layout is similar to that at Pit No. 1, and it is exactly so for the 220,000-volt equipment. There is a large 110,000-volt switch rack in addition, but the 11,000-volt switches are housed in a very similar manner. The control room, being on the second floor, overlooks the extensive high-tension switch and transformer yard. Connection is made at Vaca substation to the 110,000-volt line from the South Yuba River power house at Drum.

The transmission-line towers were furnished by the Pacific Coast Steel Company of San Francisco. The insulators were furnished by the Ohio Brass Company and the Locke Insulator Company. The high-tension switches are Westinghouse. This company also furnished the two 20,000-kva. synchronous condensers with special regulators for voltage control at the receiving end of the line. The step-down transformers were furnished by the General Electric Company.

The system was placed in operation on Sept. 30, 1922, with a clean score for all apparatus.

Financial Results of Norwegian Hydro-Electric Nitrogen Company

THE Norwegian Hydro-Electric Nitrogen Company, which makes nitric acid directly from air by the arc process, has had a remarkable financial success, according to E. Kilburn Scott. As a manufacturing concern it is a triumph of exact scientific engineering skill, and as a financial proposition it is unique, he declares. Unlike some other companies, this concern has paid handsomely ever since it started, seventeen years ago. It is estimated that the total annual output is worth over £2,000,000. During the last ten years the capitalization of the company has increased enormously until it is now 57,000,000 kroner, or £3,200,000 at normal exchange, and the capital of Rjukanfos, one of the subsidiaries, is 100,000,000 kroner, or £5,500,000. The dividends on common and preferred stock have increased from 5 per cent and 8 per cent respectively to 15 per cent.

FINANCIAL DEVELOPMENT OF THE NORWEGIAN HYDRO-ELECTRIC NITROGEN COMPANY

	Year 1913	Year 1917	Year 1920
Income from Svaelgfos-Notodden	8,137,489	38,404,474	16,751,345
Operating expenses, etc.	5,042,914	27,736,861	8,853,161
	3,094,574	10,667,613	7,898,184
Interest on advances to subsidiaries	3,269,098	1,410,814	766,258
Dividends on stocks of subsidiaries	2,814,127	12,638,755	20,763,351
Other income	4,506	79,174	7,790
	9,182,306	24,796,356	29,435,583
General expenses—			
Norsk Hydro annuities, loans and written off	3,967,336	4,970,303	3,704,920
	5,214,970	19,826,053	25,730,663
Amortization	1,810,276	2,471,068	875,045
Net profit	3,404,693	17,354,985	24,855,617
From last year	180,432	1,473,910	2,614,126
Total profit	3,585,126	18,828,895	27,469,744
Management fees, reserve fund, taxes, staff employees, workmen	723,248	10,861,003	2,439,277
	2,861,877	7,967,891	25,030,467
Dividends	2,468,388	5,763,960	8,645,940
Surplus	393,489	2,203,931	16,384,527

The Physics of Hysteresis Loss

Attention Directed to the Importance of the Heaviside Formula in Bringing About Co-ordination in the Essentials of This Subject

BY A. PRESS

SO MUCH has been written about hysteresis since the time of Oliver Heaviside's treatment of the subject in his "Electromagnetic Theory" (Vol. 1) that it is surprising greater co-ordination in the fundamentals of the subject has not resulted. Many of the difficulties which Professor Whitehead ably brought together in a letter to the ELECTRICAL WORLD printed on Nov. 11, 1922, can nevertheless be explained if note is taken of some recent work in which no less than two mechanical models of hysteresis have been evolved. (See *Physical Review*, June, 1922; Lees, *Philosophical Magazine*, September, 1922.)

In the writer's view too little attention has been paid to the Heaviside formula:

$$B = \mu_0 H + I = \mu_0 H + \mu_1 H = B_0 + B_1 \qquad (1)$$

Most engineers and physicists have preferred the simpler form of expression

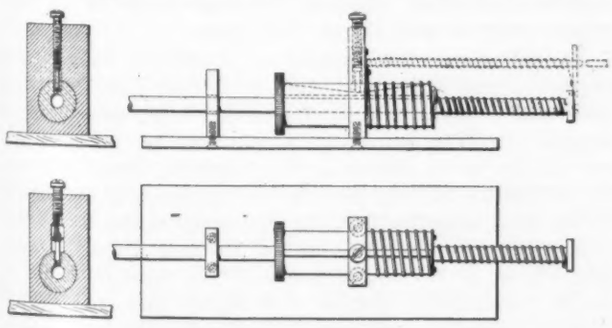
$$B = \mu H = (\mu_0 + \mu_1) H \qquad (2)$$

with consequent loss of proper emphasis. Thus it should be clear that in the ether itself there can be neither magnetic nor electric hysteresis proper. Such hysteretic phenomena as may be present at all, whether viscous or static, must be a property of matter and not the ether.

Indeed, in keeping with formula (1) for the magnetic case we also have for the electrical counterpart the formula:

$$D = D_0 + D_1 = K_0 E + K_1 E \qquad (3)$$

(See Heaviside "Electromagnetic Theory," Vol. III, page 44.) The hysteresis diagram should therefore only strictly involve the co-ordinate H or E (the applied forces respectively), on the one hand, and the magnetic displacement I and electric displacement $D_1 = K_1 E$, due to the effect of the material dielectric and magnetic material upon the circumbient ether. From the above

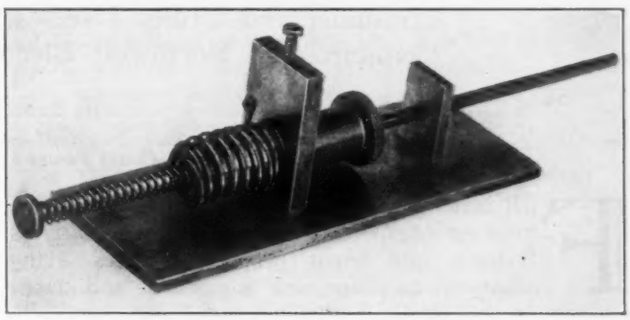


DETAILS OF MODEL APPARATUS WHICH CLARIFIES CONCEPTION OF HYSTERESIS

point of view magnetic and electric coercivities can only have proper reference to the *H-I* and *E-D* diagrams and cannot be employed in the manner hitherto obtaining in nearly all physics textbooks which have been written since the time of Ewing.

Conduction phenomena can never be considered as a pure ether effect. It properly refers to the material medium as contradistinguished from the enveloping ether. The same thing is true of the term dielectric strength. (A recent writer aimed to measure the dielectric strength of the ether!) To speak of the resistance of the ether is equally absurd, for conductance cognates matter, not the ether.

To answer the hysteretic conundrum of Professor Whitehead attention may be invited to the model. The ether has permeability μ_0 (k_0 for the electric case) and is simulated as a spring constraint between the rod, giving the displacement B or D, and the enveloping barrel giving the displacement $B_1 = I$ or D_1, due to the influence of the magnetic material or dielectric matter upon the ether. The ether co-ordinate of displacement is with respect to the frame supporting the rod and barrel.



MODEL FOR EXPLAINING ACTION OF HYSTERESIS

The I and D_1 displacements are controlled by the barrel spring between its one end and the above frame. To produce hysteretic lag a frictional constraint is introduced mounted on the frame and engaging with a groove on the outside surface of the barrel in question. A set screw and spring within the vertical support of the frame controls the frictional contact between a lug and the spline mounted hollowed-out to give greater frictional constraint for extreme movements of the barrel.

LUG ACTS AS A PISTON

To simulate viscous hysteresis it is necessary to have the lug above referred to working as a piston within the leaky confines of the vertical support. This is illustrated in the figure. On the other hand, diamagnetism is indicated by an additional spring control between the further end of the rod (see dotted line) and the supporting frame.

Let us then see to what extent known hysteretic phenomena are explainable by means of the above clarifying model. Professor Whitehead refers to electric soakage. This is explainable by the fact that the frictional constraint has included a leaky piston in the bore of the frame in which the friction spring occurs. On the other hand, it is very clear that at high periodicities the piston chamber, whether under compression or tension, has no time to permit any material leakage to occur, and therefore the apparent dielectric constant varies.

It is true that on a sudden application of direct-current potential only the initial charge should be taken to obtain the true dielectric constant for high frequencies. Needless to say, there is no obvious interconnection between the leakance of the piston chamber or the strength of the spring controlling the friction contact and that true resistance factor of the material which is in the nature of a fluid frictional property of

the conduction current rather than the material dielectric counterpart. For there are in fact two types of dielectric—the ether dielectric with its Maxwellian displacement current dD_o/dt and the less emphasized material dielectric with its displacement current dD_s/dt, neither of which constitutes a conduction current in the Maxwellian sense. Loss may, however, occur with respect to dD_s/dt (hysteresis) but not with respect to the former.

It may be noted in passing that the proposed mechanical model for hysteresis can be helpful in understanding mechanical phenomena. Thus the spring constraint on the rod corresponds to the crystalline conservative element of the metal, whereas the barrel constraint and its frictional hysteresis-producing control would have to correspond to the non-conservative filler or amorphous material between the crystals.

Economics of Rural Line Extensions

Growing Demand for Service Makes Simple Rules Protecting Both Consumer and Utility Necessary—Annuity Plan as Evolved by Committee of Northwest Electric Light and Power Association

By R. M. BOYKIN*
Vice-President and General Manager
North Coast Power Company, Portland, Ore.

FOR many years there has been a persistent and growing demand for electric service from farmers and small property owners living adjacent to improved highways and large centers of population. This demand is constantly increasing as highways are improved. The problem of determining upon what basis the rural line extension should be made is largely financial, but there are commercial and practical problems that should be considered, and possible future growth must never be forgotten. These matters have had serious consideration from executives, engineers and commercial men belonging to the utilities of the Northwest and other sections. In some instances well-meaning staffs of state regulatory bodies have attempted to make rules in an endeavor to cover adequately all questions that may arise. The resulting rules have become involved beyond description, are wholly or partly unworkable, and fundamental principles have been buried in a maze of meaningless words.

During the past two years the technical committee of the Northwest Electric Light & Power Association, feeling that line extensions into rural districts should be encouraged, since these districts are the backbone of our national life, has devoted a great deal of time and study to the solution of the problem of financing rural extensions. This study was predicated upon the fact that rules as simple as the facts underlying their making and equitable alike to the utility and the consumer are the only kind that will survive. It was recognized that of necessity all points could not be covered in the rules and that such a task should not be attempted. The purpose of the rules should be to establish a working basis for determining the amount which any electrical utility can afford to invest in an extension, with due regard to the interests of existing consumers, assuming that at the time the utility is in successful operation and reasonably able to finance itself. The rules should also determine under what conditions such an extension may be required when the investment necessary is greater than what is justified by the return.

A line extension is defined as a branch from or a continuation of an existing primary or secondary distribution system, or both, to serve new customers. A line extension includes all labor, material and apparatus used in the line extension up to the customer's service outlets and includes the meter. Reinforcing existing lines or increasing the capacity of transformers to provide additional capacity for existing customers should not be considered as a line extension.

That part of the cost of increasing the capacity of existing lines and apparatus and that part of the cost of overbuilding of secondary lines with primary lines which is made necessary by an extension to serve new customers should be considered a part of the cost of such line extension.

TRANSMISSION AND DISTRIBUTION SYSTEMS MUST BE SEPARATED

A primary or secondary distribution system should not be confused with a transmission system used primarily for the transmission of electrical energy between generating stations, between substations or between generating stations and substations.

A line extension may consist of poles, wire, transformers and other material and apparatus, or it may consist only of wire on existing poles.

To determine the amount a utility in "successful operation and reasonably able to finance itself" should invest in a rural extension, the following language is suggested: "The minimum amount to be invested by any utility in an extension will bear the same ratio to the estimated annual revenue from the new extension as the total investment in the distribution system of the utility bears to the total annual revenue from the system. That is to say, if the utility's total investment in its distribution system is $100,000 and the annual revenue from this system is $50,000, then the investment ratio is two to one and the utility should invest two dollars in an extension for every dollar of estimated annual revenue to be derived from the extension." No prospective rural customer complains, but rather considers himself fortunate when told he will receive service upon the same ratio of investment to earnings as his urban brother.

The necessary investment in rural lines is frequently several times the ratio above referred to. It is the provision of funds to meet this excess cost and caring

*Chairman technical committee Northwest Electric Light and Power Association.

for the fixed charges thereon that troubles the utility and the customer and is the only real problem that has been a nightmare to regulating authorities and utilities alike. The utility is often more able than the customer to provide the funds to meet this excess cost in the line and facilities, in which case the customer, in addition to the rates, should pay annually certain charges on the excess investment until the rural line extension becomes self-supporting. It should be remembered that the rates paid to a "successfully operated utility" reflect all cost and a reasonable return on "the minimum amount to be invested by any utility." The annual amounts that should be paid by the customer on the excess cost, or investment, until the rural line extension is self-supporting are as follows:

A—Interest (return or cost of money).
B—Taxes.
C—Depreciation.
D—Operation.
E—Risk and contingencies.

These items should be expressed as a percentage of the excess cost in the rural line extension and in many cases have been found to be: A, 8 per cent; B, 1 per cent; C, 5 per cent; D, 6 per cent, and E, 2 per cent.

An inquiring mind would ask: "When does a rural line extension become self-supporting and the customer cease paying the fixed charges on the excess investment in the extension?" The extension may be said to be self-supporting when the ratio of the total investment in the extension to the revenue derived from the extension equals the investment ratio for the specific system under consideration as defined above. There will be in most rural extensions a gradual increase in the business and revenue from the lines as the territory served becomes more settled, so that the annual payments, A to E inclusive, should gradually decrease and become nil when the extension is self-supporting. The annual amounts that should be paid by the customer on the excess cost should, therefore, be for each year one-half of the first year's payment, and this sum should be paid each year until the self-supporting period arrives. This period can be obtained from statistics and fairly closely estimated. The length of time required for an extension to become self-supporting will perhaps vary in many sections of the utility property and will be from a few years in some sections to perhaps twenty years or longer in others.

It is highly desirable to close the transaction with the customer at the time the contract is made, rather than have the average annual payments on account of the excess investment in the line paid in annual instalments up to the beginning of the self-supporting period.

THE ANNUITY PLAN

To enable the transaction to be closed at the time of executing a service contract by a customer the annuity principle of finance is recommended. Such a plan contemplates the payment to the utility by the customer of the principal of an annuity computed at 4 per cent compound interest. The yearly payments earned by the principal of the annuity should be sufficient to return to the utility the average annual payments (one-half of A to E inclusive each year) necessary to defray the charges on the excess investment in the rural extension to the time it becomes self-supporting. At the end of this period the principal is exhausted. The following table shows the payment necessary in order to produce $1 per year for the years shown and at the end of each year, the principal being exhausted. The computation is at 4 per cent compound interest.

Period of Years	Principal	Period of Years	Principal
5	$4.452	15	$11.118
8	6.733	18	12.65
10	8.111	20	13.59

Since it is proposed that the extension shall be financed by the utility, the title should remain with the utility; also, since the amount paid by any prospective customer is only sufficient on the average to make good the actual deficit resulting from the construction and operation of such extension, no customer is entitled to a refund of any amount paid by him.

DETAILS OF METHOD

The following example will aid in a clear understanding of the method of financing that is proposed:

Applicants—rural lighting residence	5
Estimated cost of providing service	$510
Annual estimated gross earnings from tariff	$130
Estimated time to become self-supporting	10 years

FACTS

Investment in company distributing system	$100,000
Gross earning from company distributing system	$50,000
Investment ratio	$2.00 to $1.00
Payments on excess investment, per cent	22

SOLUTION

Minimum investment that should be made by company, $130 × 2	$260.00
Excess investment, $510 — $260	250.00
Fixed charge on excess investment 22 per cent of $250	55.00
Average annual fixed charge, half of $55	27.50
Principal of annuity to be paid by customer to company, 8.111 times $27.50	223.05
Amount to be advanced by each customer to defray deficits for ten years	44.61

The rates charged should be those prevailing for the same class of service in the nearest urban district, with perhaps higher minimums to compensate for additional losses in longer lines and greater transformer losses. Utility representatives and commission engineering staffs have given much thought to the matter of refunds, a somewhat vexing problem. From the commercial and practical side of the problem refunds are a source of annoyance. The idea of finance expressed above eliminates this problem. It should be borne in mind that the utility must develop its rural business on a basis that will be self-supporting within a reasonable time, but care should be used so as not to reflect a burden on the urban consumers. Whatever scheme of financing rural extensions is evolved it must be one to encourage and develop rural electric service. On this point the Wisconsin commission says: "Not only must the business be permitted to earn the same rate of return as is reasonable for urban business, but the utility must be permitted to make terms as to financing which will make possible the immediate investment of considerable sums of money in rural extensions without taxing the resources of the utility for securing capital."

Many ideas have been expressed as to methods of finance. Some advocate that groups of customers organize and engage in utility business. Such ideas have little or no merit. Encouragement of such organizations by the supplying utility is an effort to evade the responsibility. This plan is discouraged.

After a thorough study of many financial plans taking into consideration the commercial, practical and future aspects of rural line extensions, the natural conclusion drawn is that the subject is so involved that only a few simple rules should be made. To cover every point adequately is impracticable and out of the question.

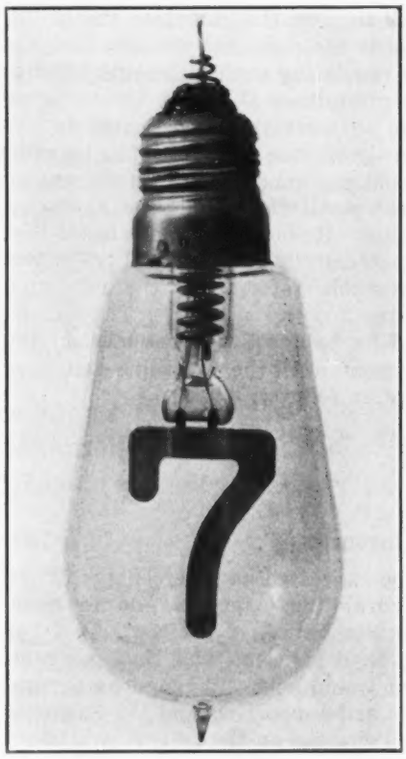
The Neon "Glim Lamp"

A New Signal and Decorative Lamp for Use on Higher Voltage Distribution Circuits Which Uses Electric Discharges in Neon Gas

BY ARTHUR PALME
Pittsfield, Mass.

THE glim lamp derives its luminosity from an electric discharge between two electrodes placed together and inclosed in a rarefied atmosphere of neon gas. The lamp operates like an electric valve; that is to say, if a direct-current potential of more than a certain critical minimum is placed upon its two electrodes, the cathode will be luminous, the anode will remain dark. If alternating current is impressed, both electrodes will *appear* to be simultaneously luminous. In fact they are luminous one at a time, but with commercial frequencies of 25 cycles to 60 cycles the alternations of light and dark will occur so rapidly that the eye will see only a permanent glow of both electrodes simultaneously. At 25 cycles, however, the flicker is quite pronounced. The critical or minimum voltage to start any visible discharge is 180 volts for direct current and 130 volts for alternating current. The color of the luminous electrodes is a pleasing pinkish-orange with a blue-violet fringe on the edges. The manufacturer labeled the lamps "5 watts, 210-240 volts." Actual measurements showed a consumption of 11 milliamperes for alternating current and 8.8 milliamperes for direct current at 220 volts in both cases. The difference between the amount of current required by a lamp fed by alternating current and the amount required by the same lamp fed by direct current might permit one to assume the power factor of the lamp to be in the neighborhood of 0.8, but as the lamp is really a small condenser, this figure appears to be much too high.

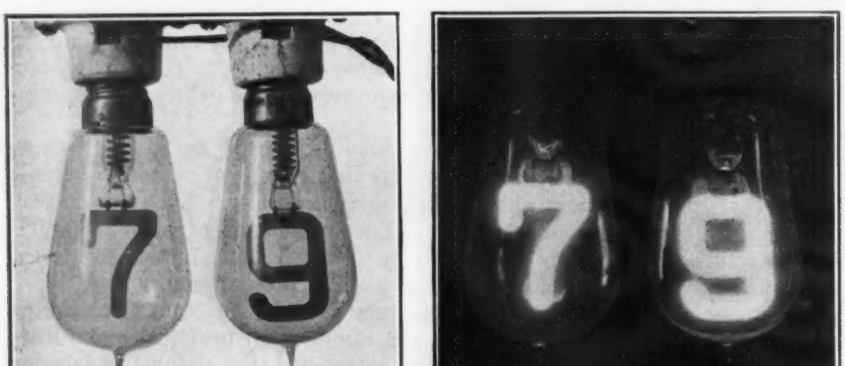
The shape of the electrodes is governed solely by the use of the lamp. The most obvious use of these lamps is for sign lighting in the form of letters to spell out words or names, etc., or in the form of figures for luminous house numbers. Any word may be spelled out with a number of letter lamps mounted closely side by side; but a limited number of letters or numbers may also be combined in one long glass tube to spell out a complete name or a high house number. For instance, the name of a doctor may be spelled out in one tube and mounted over the entrance to the physician's house, the lamps continuing to burn during the night hours. Assuming a consumption of 2 watts per letter, a sign bearing the name "Dr. Jones" would require only about 15 watts, and its operation at a charge of 10 cents per kilowatt-hour would cost about 1½ cents for ten hours. For general signal lights the electrodes are shaped in the form of a semisphere, radiating the light uniformly downward at all angles. The brightness of the lamps is about 0.7 cp. to 1 cp., but the pinkish light is very conspicuous and can be seen easily even in daylight and for a considerable distance. Such plain signal lamps have a great variety of uses. They make excellent indicator lamps to show the position of a switch in circuits of more than 130 volts alternating current, the lamp being connected parallel to the switch. The lamp will burn at open switch, regardless of the ohmic resistance in the consuming circuit, because the latter is as a rule infinitely smaller than the very high internal resistance of the lamp. Connected in parallel to a fuse, the lamp will indicate the blowing of the fuse. A lamp with one electrode shaped like a plus sign and the other like a minus sign can be used as a very simple polarity tester for all direct-current circuits of 180 or more volts.



ACTUAL SIZE OF LAMP, SHOWING DETAILS OF CONSTRUCTION

All bulbs containing a letter or a figure have fastened to the central contact on the Edison base a short wire spiral, so that proper contact is insured for more than a full turn in the socket. This will permit one to turn the lamp always to the right position, regardless of the depth of the socket thread.

For European conditions, where 220-volt distributing systems outnumber overwhelmingly the 110-volt networks, these lamps become popular in a remarkably short time. For 110-volt direct-current circuits they are obviously useless. On alternating-current 110-volt supplies a small booster transformer is all that is needed. This transformer should be wound preferably as a 110/220-volt auto-transformer and should have a rating according to the number of "glim lamps" to be energized, calculating 2 watts to 5 watts per lamp or per letter. The so-called "toy transformer" has more than ample capacity to supply ten of these lamps. The manufacturers guarantee them a life of several thousand hours.



THESE NEON LAMPS ARE POPULAR IN EUROPE ON THE 220-VOLT CIRCUITS —BEFORE AND AFTER ILLUMINATION

Some Economic Phases of Engineering

Methods of Evaluating Increase of Equipment Efficiency in Studies of Plant Design Suggested—Mathematical Formulas that Have Been Developed for Such Studies

By GEORGE F. MARSTELLER
Electrical Engineering Department, Utica Gas & Electric Company

ENGINEERS whose duty it is to approve specifications of apparatus, layouts of systems and similar work do not always give sufficient consideration to the underlying economics of their problems. For some cases there is a tendency to get the best quality regardless of cost or to make sure of some quality regardless of value. The mechanical, electrical or thermodynamic efficiency either receives too much attention or not enough. The following article embodies a few reflections along these lines which it is hoped may at least stimulate a more considerate attitude toward this interesting subject.

When the constancy or variation of conditions over a given period of time can be ascertained with a reasonable degree of accuracy or reliability, it is the aim of all true engineering to specify machinery equipments or entire systems which will have an economic efficiency that will ultimately earn the greatest financial returns on a given investment of capital and not necessarily have the greatest physical efficiency at lowest or highest first cost. For example, to obtain the greatest number of kilowatt-hours from the least possible number of B.t.u.'s or pounds of coal does not necessarily imply the most economical operation, since it may require too great an investment. Illustrations could be cited where many an otherwise fine and modern installation incurs at least twice the service cost necessary to perform its economic function properly. Obviously, then, the specification of any apparatus, unit or equipment available for selection does not depend on the first cost or physical efficiency alone, but on their mode of operation, interest charges, useful life and load factors of power and time as well.

As in most practical engineering calculations so also in this domain does the correct solution of a problem depend upon certain premises or constants. Evidently, the accuracy of the most elaborate method of calculation can never exceed the trustworthiness or reliability of these constants. This statement, too, is another mathematical axiom which seems often to be entirely overlooked. Naturally, then, in the correct determination of these constants or suppositions much caution is required, since here experience and research are at a premium and find their greatest value. Hasty conclusions and too close adherence to conventional methods, sometimes established by custom or prestige rather than by practical facts, often lead to unjustifiable errors.

One item which is commonly subject to these propensities is the depreciation rate. For instance if the life of a unit is taken as fifty years, then the depreciation rate is generally taken to be $100 \div 50 = 2$ per cent; i. e., if R is the depreciation rate in per cent and n the number of years, plotted against each other, then $100 = nR$ is thus assumed to follow a curve represented by a rectangular hyperbola. A little examination will readily show that such an assumption is incorrect, since it entirely fails to take into account the steadily growing interest on the depreciation reserve accumulated.

An abbreviated derivation of the following formula, based upon the well-known compound-interest principle, will illuminate this point:

Let E = first cost of the unit or equipment,
V = annual amount to be set aside for depreciation,
I = interest rate on money,
R = depreciation rate.

Provided that the very indefinite scrap value of the unit or equipment to be replaced shall be considered applicable to the new purchase and not be treated as if it were a capital asset, the equation $R = V/E$ will give exact values of the depreciation rate.

The depreciation reserve M at the end of the first year is evidently:

$$M_1 = V \tag{1}$$

At the end of the second year we have:

$$M_2 = M_1 (1 + I) + V = V[(1 + I) + 1] \tag{2}$$

At the end of the third year:

$$M_3 = M_2(1 + I) + V = V[(1 + I) + 1] (1 + I) + V$$
$$= V[(1 + I)^2 + (1 + I) + 1] \tag{3}$$

Multiplying M_2 by $(1 + I)$, we get:

$$M_2(1 + I) = V[(1 + I)^2 + (1 + I)^2 + (1 + I)] \tag{4}$$

Substracting (3) from (4), we have:

$$M_2[(1 + I) - 1] = V[(1 + I)^2 - 1] \tag{5}$$

and consequently from (5):

$$M_2 = \frac{V}{I}\left[(1 + I)^2 - 1\right]. \tag{6}$$

Similarly, at the end of the fourth year:

$$M_4 = \frac{V}{I}\left[(1 + I)^4 - 1\right]. \tag{7}$$

And in general, at the end of any number of years, or n years:

$$M_n = \frac{V}{I}\left[(1 + I)^n - 1\right]. \tag{8}$$

But at the end of n years the depreciation reserve must equal the first cost E, so that:

$$E = M_n = \frac{V}{I}\left[(1 + I)^n - 1\right], \tag{9}$$

and the depreciation rate being $R = V/E$, substitution gives:

$$R = \frac{V}{E} = \frac{I}{(1 + I)^n - 1}. \tag{10}$$

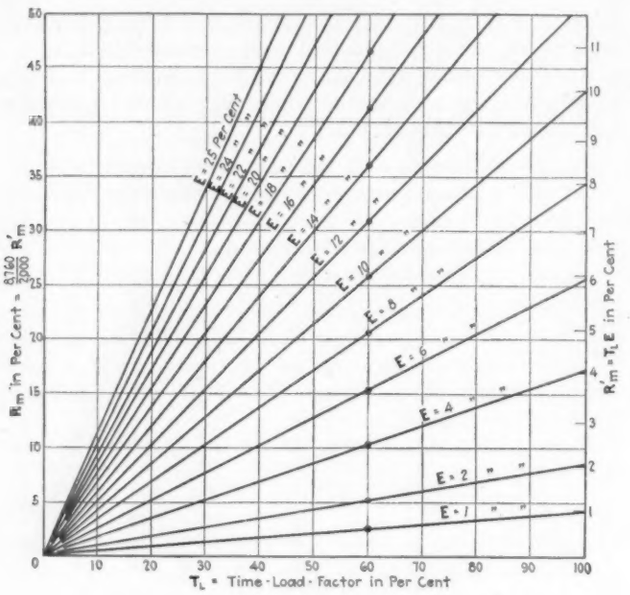
If it be assumed that the useful life of the machine or equipment is say, fifty years, and the interest on money, I, is 5 per cent, the formula (10) would give:

$$R = \frac{0.05}{(1 + 0.05)^{50} - 1} = 0.4777 \text{ per cent},$$

thus showing an error of nearly 315 per cent with

respect to the conventionally acquired depreciation rate of $100 \div 50 = 2$ per cent. For the same interest rate the error decreases as n decreases, but even at $n = 25$ years, the difference would still be 91 per cent. At $I =$ 10 per cent and $n = 25$ years, the error would be $(4 - 1.0168) \div 1.0168$, or about 294 per cent. It is, therefore, evident that this subject of depreciation, and appreciation for that matter, cannot be taken lightly.

Sometimes a few calculations will throw light on points which seem uncertain and entirely indefinite, thus arriving at comparative values that fit the special con-


E = 25 Per Cent
E = 24 " "
E = 22 " "
E = 20 " "
E = 18 " "
E = 16 " "
E = 14 " "
E = 12 " "
E = 10 " "
E = 8 " "
E = 6 " "
E = 4 " "
E = 2 " "
E = 1 " "
R_m in Per Cent = $\frac{8760}{2000} R'_m$
$R'_m = T_L E$ in Per Cent
T_L = Time-Load-Factor in Per Cent

A GRAPHIC CHART AIDS IN MAKING EASY THE MATHEMATICAL SOLUTIONS

ditions under consideration. As an illustrative example, let it be desired to determine the additional investment we can afford for a new machine of similar capacity and general mechanical features, but having a perceptible increase in efficiency.

Let the old machine be a turbo-generator, costing originally, say, $80,000. Furthermore, let 7,500 = kw. capacity of both old and new machine. Also, let this be the mean load, differing more or less from this constant load for a total time which is negligible in comparison with the time of the total yearly run.

20 = estimated useful life of machine in years,
11 = percentage of interest, taxes, depreciation, etc.
12.8 = pounds of steam per kw.-hr. of old machine,
12.4 = pounds of steam per kw.-hr. of new machine,
8,760 = hours per year,
8 = pounds of steam per pound of coal,
$\frac{3.2}{2,000}$ = price per pound of coal in dollars,
$\frac{1}{3}$ = time-load factor; i.e., that factor which, multiplied by 8,760 gives the total number of hours during which the machine was running throughout the year.

Then, from the above, the total annual interest charges will amount to:

$$80,000 \times 0.11 = \$8,800.$$

Cost of coal per year for old machine:

$$\frac{12.8}{8} \times 7,500 \times \tfrac{1}{3} \times 8,760 \times \frac{3.2}{2,000} = \$56,064.$$

Cost of coal per year for new machine:

$$\frac{12.4}{12.8} \times 56,064 = \$54,312.$$

Saving in coal due to increased efficiency:

$$56,064 - 54,312 = \$1,752.$$

Since the annual interest charges on the old machine amounted to $8,800, the additional investment on the new machine over the old one can *at the most* be such that the annual interest charges on the difference in cost equal the annual saving in total operating expenses. If we pay more than this without a compensating feature of some sort within the useful life of the apparatus, more money must be paid out on account of additional interest charges than is coming in from a saving in operating expenses in the form of increased efficiency, decreased maintenance, attendance, etc.

Since for simplicity of illustration we have assumed the general structural features of the more efficient machine to be similar to the old one, the items of attendance, maintenance, etc., will also be the same, and therefore cancel each other for the purpose of economic comparison. Where such items cannot be assumed identical within a reasonable degree, they naturally must be taken into consideration also.

The general condition may be represented symbolically as follows. Let:

O_1 = operating expenses of old machine,
O_2 = operating expenses of new machine,
M_1 = investment in the old machine,
M_2 = investment in the new machine,
I_n = total interest charges.

Then, for the total annual charges against the two machines to be equal we must have:

$$M_2 I_n + O_2 = M_1 I_n + O_1$$

hence,

$$M_2 - M_1 = (O_1 - O_2)/I_n \qquad (A)$$

If for any reason the interest charges should not be the same, then evidently:

$$M_2 I_{n_2} + O_2 = M_1 I_{n_1} + O_1$$

and

$$M_2 = \frac{O_1 - O_2}{I_{n_2}} + M_1\left(\frac{I_{n_1}}{I_{n_2}}\right) \qquad (B)$$

Returning to the numerical values above and substituting, we have:

$$M_2 - M_1 = 1,752/0.11 = \$15,927.28.$$

Therefore: $M_2 = (80,000 + 15,927.28) = \$95,927.28$, which represents the greatest total investment that can be allowed for the new machine.

To determine the interdependence between two or more quantities, we can generalize these relations algebraically and may proceed as follows. Let:

S_1 = pounds of steam per kw.-hr. of old machine,
S_2 = pounds of steam of new machine,
O_1 = yearly operating cost of old machine,
O_2 = yearly operating cost of new machine,
M_d = initial cost of old machine,
M_w = greatest permissible cost of new machine,
P = pounds of steam per pound of coal,
T_L = time-load factor (as defined previously),
I_n = interest charges, assumed same for both,
Kw. = capacity of both old and new machine, running at a nearly constant mean and rated load,
$C/2,000$ = cost per pound of coal in dollars,
8,760 = number of hours per year.

The yearly operating cost in coal for the old apparatus is then:

$$O_1 = \frac{8{,}760 \times T_L \times \text{kw.} \times C \times S_1}{2{,}000 \times P}$$

$$= 4.38 T_L C \text{kw.} \times \left(\frac{S_1}{P}\right) \quad (1)$$

If $S_2 < S_1$, as it obviously should be, we have:

$$O_2 = S_2/S_1\, O_1 = 4.38 T_L C \text{kw.} (S_2/P) \quad (2)$$

And

$$O_1 - O_2 = 4.38 T_L C \text{kw.} [(S_1 - S_2)/P] \quad (3)$$

Therefore

$$V = M_w - M_d = 4.38 T_L C \text{kw.} [(S_1 - S_2)/P I_n] \quad (4)$$

where V is the difference in investment cost between the two machines, or the greatest allowable additional investment as the price of increased physical efficiency.

Now, $(S_1 - S_2) = S_1(1 - K')$, where K' is a factor such that $S_2 = S_1 K'$ and $K' = S_2/S_1$, and therefore $100 S_1/S_1 (1 - K') = 100(1 - K_1) = E =$ *increase* in per cent in efficiency of the new machine over the old one.

Consequently,

if $K' = 0.98$, $E = 2$ per cent,
if $K' = 0.96$, $E = 4$ per cent,
if $K' = 0.93$, $E = 7$ per cent,
if $K' = 0.90$, $E = 10$ per cent, etc.

However, the actual expenditure will equal:

M_2 + cost of removal — depreciation — salvage, etc.

Putting $C = P = I_n =$ kw. $= S_1 = 1$, equation (4) above reduces to $R_m = M_w - M_d = 4.38 T_L (1 - K')$, where R_m will be a coefficient which when plotted against T_L is proportional to E, and equation (4) becomes:

$$V = M_2 - M_1 = (C\text{kw.} S_1/P\, I_n)\, R_m \quad (5)$$

Since R_m is a straight-line function between E and T_L, it is only necessary to compute the various values of R_m for one value of T_L, say 60 per cent, and connect these with the origin of the rectangular co-ordinates, and for purpose of plotting:

$$R_m = 4.38 \times 0.6 \times E = 2.628\, E. \quad \text{(See Fig. 1.)}$$

In the foregoing numerical example we have: $K' = S_2/S_1 = 12.4/12.8$; $T_L = \frac{1}{3} = 33.33$ per cent, then:

$$R_m = 4.38/3 \times [1 - (12.4/12.8)] = 0.045625,$$

or since $E = 1 - 12.4/12.8 = 3.12$ per cent, such values as R_m could be read off a diagram directly, and therefore from (5) we get:

$$V = \left[\frac{3.2 \times 7{,}500 \times 12.8}{8 \times 0.11}\right] \times [0.045625] = \$15{,}927.28,$$

which is the same result as attained formerly.

From the diagram it is evident that a time-load factor of, say, 38 per cent and 12 per cent increase in efficiency is economically equivalent to a 57 per cent time-load factor and 8 per cent increase in efficiency, since evidently for the same value of R_m (or more generally R'_m) $38 \times 12 = 57 \times 8$, etc. In general $T_{L_1} E_1 = T_{L_2} E_2 = T_{L_3} E_3 = R'_m$, and therefore we can readily read off from such a diagram by what percentage we may increase and correspondingly decrease either the time-load factor or the gain in efficiency and still justify the same greatest permissible investment.

In the previous simple problem the comparative values of S_1 and S_2 alone were considered. In a similar manner any other factor or combination of factors could be studied. By attaching to the values of E in Fig. 1 a broader meaning than the previous example would seem to indicate and using it in connection with R'_m various useful results may be readily read off.

It must be remembered that until now we have dealt with the cases of loads which were considered practically constant. Since it is rarely the case that, for example, a turbo-generator carries the same load continuously, modifications of the foregoing formulas must be made to allow for the conditions of a constantly variable and fluctuating load.

This phase of the subject will be discussed as applied to a specific illustration in an early issue of the ELECTRICAL WORLD.

Analysis of a Building Program

Graphs Used to Make Concise and Readable Masses of Figures Needed in Power Company's Building Program

BY CHARLES P. DUNN
Seattle, Wash.

THE detailed study of even a simple central-station building program involves a great many pages of output calculations and cost estimates, and the summary is often a confusing array of figures which are difficult to visualize in their proper relations and to weigh one against the other, unless the results of the study, stripped of all trimmings, are presented in the form of graphs. Often much of the work connected with the calculations can be done graphically with sufficient accuracy and with a small fraction of the labor that would otherwise be required. Excessive refinement of calculations pertaining to future events is futile. The work is fundamentally a guess, a scientific guess to be sure, but figures carried out to the nth decimal place do not fool the business men to whom the work

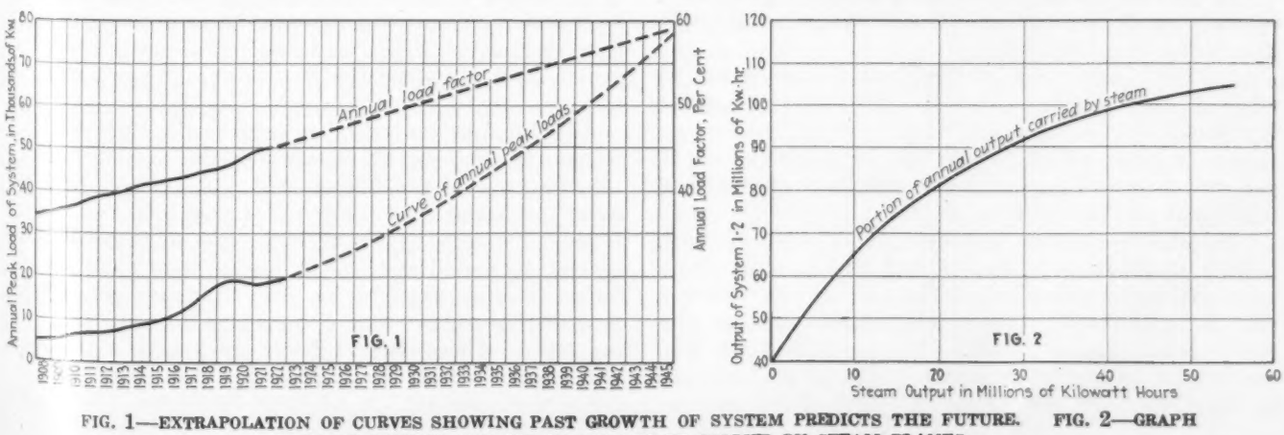

Annual Peak Load of System, in Thousands of Kw.
Annual Load Factor, Per Cent
Annual load factor
Curve of annual peak loads
FIG. 1
Output of System 1-2 in Millions of Kw-hr.
Portion of annual output carried by steam
FIG. 2
Steam Output in Millions of Kilowatt Hours

FIG. 1—EXTRAPOLATION OF CURVES SHOWING PAST GROWTH OF SYSTEM PREDICTS THE FUTURE. FIG. 2—GRAPH TO DETERMINE AMOUNT OF LOAD TO BE CARRIED BY STEAM PLANTS

is presented and do not increase their respect for the man who does the guessing.

Almost any industrial enterprise might profitably be visualized in the manner indicated by the following brief outline of a study of a power company's expansion program.

Fig. 1 shows an estimate of future loads and load factors extrapolated from the curve of past performance or calculated from probable local conditions which may influence the growth of the industry.

The present plant is assumed as consisting of:

(1) A 15,000-kw. hydro-electric plant, with daily storage only, with output limited to 10,000 kw. on 50 per cent annual load factor in dry years; cost $2,500,000.

(2) A 15,000-kw. steam plant; cost $1,500,000.

The future possibilities to be considered are:

(3) A hydro-electric plant of 22,000 kw. capacity on 50 per cent annual load factor, with storage ample for complete control of stream flow; plant to cost $3,500,000, of which $2,500,000 is invested in works which will be a part of plant (4).

(4) The extension of (3) to a plant of 80,000 kw. capacity on 55 per cent annual load factor, at an additional cost of $6,000,000.

(5) The construction of the plant described as (4) without the preliminary step (3), at a cost of $8,500,000.

(6) Increase of (1) to 20,000 kw. capacity on 50 per cent annual load factor by additional storage and additional machinery, at a cost of $1,500,000.

(7) Additional steam installation at $90 per kilowatt.

By a study of loads, load factors and hydrographs a series of performance calculations are made covering each possible combination of the present system with the proposed future plants. The portion of the load which must be carried by steam at various system loads is determined for the different combinations and for convenience is recorded in curves, of which Fig. 2 is a sample.

The probable performance having been determined, cost of power curves can be obtained by considering fixed, operating, maintenance and fuel charges. These curves are shown in Fig. 3, the vertical scale being cost per kilowatt-hour, the horizontal scales being time, peak load, annual output and annual load factor.

The curves in Fig. 3 are identified by groups of numbers representing combinations of the possibilities listed above, as: Curve 1-2 represents the cost of power delivered by the present system at various loads; curve 2-6 represents the present system with the present hydro-electric plant expanded as per item 6 in the preceding list; curve 1-2-5 shows the cost of power with the 80,000-kw. plant added to the system at once and forcefully pictures the folly of over-construction.

The object to be attained is to plan the construction

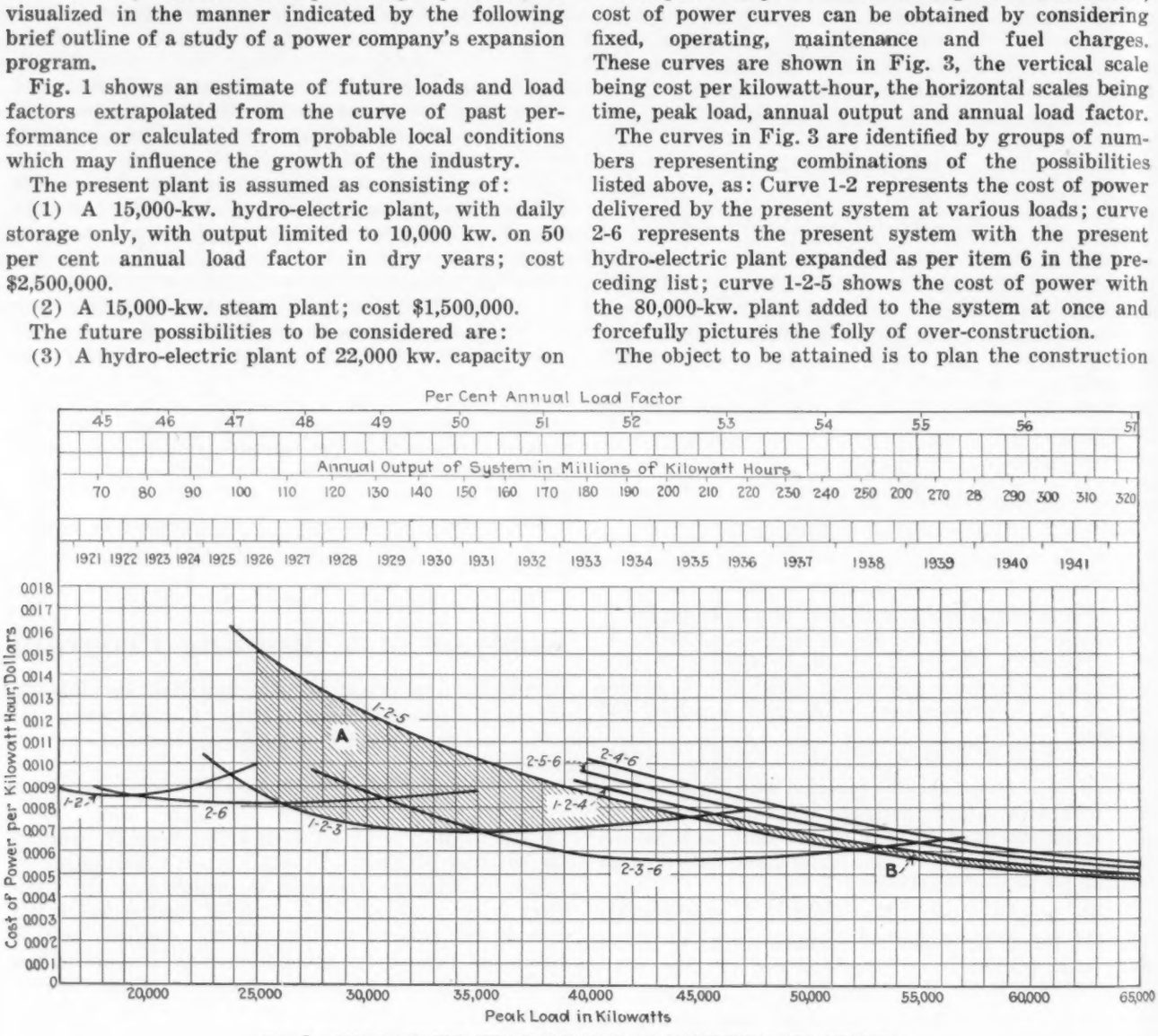


FIG. 3—COST OF POWER CURVES OBTAINED BY CONSIDERING ALL CHARGES

so that the costs follow as nearly as possible the lower limit of the group of curves. It is evident that the extension of the present plant as per item (6) would be of immediate advantage if it could be put in operation at once. However, by the time this extension could be built and put in service it would be of no more advantage than group 1-2-3, and from 1925 until 1930 the group 1-2-3 gives the cheapest power of any combination.

Additional power must be ready by the time the load reaches the dry-season capacity of the present system (25,000 kw.) in the fall of 1925. The choice lies between 1-2-3 and 1-2-5 for the first step in the program. If plant No. 5 is built at once, the cost of power will be sharply increased and will be higher than could be obtained in other ways for at least ten years, the advantage of this construction being more than ten years in the future, where curve 1-2-5 is the lowest of the four nearly parallel curves. If plant No. 3 is built, we may follow the curve 1-2-3 to a load of 46,000 kw., then make

the change to 1-2-4, or we may follow 1-2-3 to 35,000 kw., then 2-3-6 to 56,000 kw., then 2-4-6.

There is little doubt that the first proposition, 1-2-5, is inadvisable because it would cause a loss represented by the shaded area A against a gain represented by the shaded area B. The second and third propositions appear to be nearly equal in value, and a decision between the two requires careful study. In comparing savings on the chart it must be kept in mind that a dollar saved in 1925 is worth considerably more than one saved in 1935. It would, no doubt, in some cases be advantageous to distort the horizontal scale on the basis of "present worth" of the possible savings, so that areas under the curves would represent dollars at the present time and could be compared directly.

The upward trend of the curves near their ends is due to the cost of fuel as the load approaches the ultimate capacity of the system under consideration and a substantial load is carried by the steam plant. The addition of more steam capacity has not been shown on this chart because there is no opportunity to make a saving thereby. The construction of an additional steam plant would move all the succeeding curves up on the cost scale.

There are usually certain factors in a problem which the engineer does not attempt to express graphically because they are difficult to evaluate, such as legal proceedings, availability of funds, the value of designing the system in such a way as to insure continuity of service, etc. It must also be remembered that the immediate future is more important than the remote future; the forecast of costs and events is more accurate for the near than for the future. This concisely presented best possible approximation is much better than vague, poorly expressed guesses, and if revised from time to time to suit changing conditions, is sure to prove of great value.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Proper Ratio of Tooth Width to Slot Width

To the Editors of the ELECTRICAL WORLD:

Discussions such as that of F. S. Dellenbaugh, Jr., on page 1158 of the ELECTRICAL WORLD for Nov. 25 are very interesting and instructive and should be a help in the checking of design work. It would seem that instead of reserving the quantities B and ϕ as the working variables, ϕ and w should be so considered, since in most cases B can be taken as a constant, for, with given conditions of frequency, etc., B is of fixed value, being subject to some manipulation in extreme cases. Of course, with very narrow teeth B can be made greater without much increase of iron loss.

Taking the equation as given and operating on ϕ and w, the same conclusion is reached: Slot width should equal tooth width for the most economical results, the final value of ϕ being $L\psi B\pi D/2p$.

Some time ago the writer attacked this problem from a slightly different angle. The equations were applied to the case of an armature with a comparatively small number of paralleled side slots, giving the tooth considerable angularity and bringing in the matter of tooth depth.

Let D = diameter of armature,
L = active iron length,
t = tooth depth,
w = slot width,
n = number of slots,
Z = number of conductors in series,
E = emf. produced,
B = tooth density,
ψ = polar enclosure.

It is required to make E as large as possible by suitable relation of slot width to tooth width, assuming a given ampere capacity or size of conductor, so that output is proportional to volts.

Neck of tooth then $= \dfrac{(D-2t)\pi}{n} - w.$

$Z = Ktwn$, or the conductors in series are proportioned to total cross-section of the slots, K being a constant.

$E = \int Z\phi$, assuming the speed as fixed, and can be expressed as

$$\int Ktwn\psi BLn\left[\frac{(D-2t)\pi}{n} - w\right], \text{ or}$$

$$K\psi BL(\pi Dtwn - 2\pi t^2wn - tw^2n^2).$$

Now, letting w and t be constant, varying the number of slots n:

$$dE/dn = K\psi BL(\pi Dtw - 2\pi t^2w - 2tw^2n)$$

and

$$\pi Dtw - 2\pi t^2w - 2tw^2n = 0$$

whence $n = (\pi Dtw - 2\pi t^2w)/2tw^2,$

or $wn = \pi(D - 2t)/2,$

showing that the total neck area should be half of the perimeter at the base of the tooth.

If w and E are the variables with n and t as constant,

$$dE/dw = c(\pi Dtn - 2\pi t^2n - 2twn^2).$$

Where c is a constant,

$w = \pi(D - 2t)/2n$, which is a repetition of the above.

Suppose t is the variable, then:

$$dE/dt = C(\pi dwn - 4\pi twn - w^2n^2)$$

and $t = (\pi D - wn)/4\pi;$

but, as above, $wn = \pi(D - 2t)/2,$

t becomes $\dfrac{\pi D - \pi[D - 2t]/2}{4\pi}$ or $t = D/6.$

From which it appears that for parallel side slots the neck should equal the slot width and the depth should be one-sixth the diameter.

The last is probably of academic interest only, as other considerations would eliminate this in all but small armatures.

Another feature of particular interest is that of slot space factor. A moment's consideration will show that with decreasing slot width a point is reached where the slot insulation will cut the wire space down to nothing, such a slot having a width of twice the slot insulation plus the cotton taping or other coil insulation. As such insulation is generally greater than 0.100 in., it can readily be seen that the slot width should be substantially greater than the width of the tooth. This can be shown below where Z, instead of being equal to $Ktwn$, is now $Ktn(w - k)$, where k is the difference between slot and wire widths.

By differentiating as before, n becomes

$$(\pi D - 2\pi t)/\ 2(w - k)$$

and $w = (\pi D - 2\pi t + 2nk)/2n,$

showing that either the number of slots or their width must be increased to maintain maximum output as the slot insulation increases. This, too, is in accord with practice.

The same line of reasoning can be extended to the value of t, because here again we have a certain amount of constant loss of space at top, center and bottom of the slot, which within the limits of the design may be considered constant. The result will show that the greater the proportion of slot section occupied by anything except copper, the larger should be the slot and the thinner the teeth to secure the maximum use of material.

JOHN H. HERTNER.
Hertner Electric Company,
Cleveland, Ohio.

To the Editors of the ELECTRICAL WORLD:

Mr. Hertner's discussion upon the design of slot and tooth dimensions is very gratifying, and it is interesting to note that he obtains the same results from a slightly different standpoint. I did not intend to imply in my article that B, the tooth density, was to be considered a variable in the design. It was merely assumed as a variable temporarily and the conditions necessary for making it a minimum were determined. This obviously implies the minimum material necessary, and the flux density itself may be brought to any desired value by changes in length or diameter without affecting this minimum condition.

Mr. Hertner's further discussion upon the effect of insulation is valuable for a practical application of the results. It would be interesting in this connection to investigate also the effect of varying the size of copper as the total number of armature conductors is changed. It is usually necessary to do this in actual design since more conductors result in more heat loss, and even though there be greater facilities for conduction away from the copper, the total loss within an armature of fixed over-all dimensions must in general be approximately constant. This is a little difficult to handle theoretically since the relation between the number of conductors and the size of each one is somewhat uncertain and would vary with different types of design.

F. S. DELLENBAUGH, JR.,
Department of Electrical Engineering.
Massachusetts Institute of Technology,
Cambridge, Mass.

Laminated-Frame Arc-Welding Generators

To the Editors of the ELECTRICAL WORLD:

In your issue of Sept. 16 J. F. Lincoln illustrates the use of a stabilizing reactance in the arc circuit by comparing it to a flywheel in a mechanical system. The illustration is made clearer if this splendid analogy is carried a step further. Obviously the current in the electric system corresponds to velocity or speed in the mechanical system, and the voltage corresponds to force or torque. The purpose of adding flywheel effect is evidently to oppose rapid changes in speed and never to assist in obtaining "almost instantaneous adjustment of speed." Its function is to assist or oppose the torque of the driving mechanism in accordance with the torque requirements of the load so as to maintain nearly uniform velocity. Similarly, in a direct-current circuit, electromagnetic inertia or inductance is inserted for the very purpose of opposing sudden changes in the current by assisting or opposing the generator terminal voltage.

Manifestly, the object sought by laminating the frame is then to make the generator itself adjust its terminal "voltage" rapidly enough to maintain nearly uniform current with less assistance from the reactance. In my letter of Sept. 9 I criticised a statement in a catalog, that lamination of the frame makes it possible for the "electric current" to adjust itself "almost instantly" to any demand. My statement in this connection was: "The idea which it is intended to convey probably is that a rapid change of flux permits a rapid change of terminal voltage, so that a substantially constant current can be maintained when the resistance of the arc circuit varies rapidly." This statement harmonizes perfectly with Mr. Lincoln's mechanical analogy, and had he read my letter carefully, he would probably have arrived at a different conclusion in regard to my missing the point on this subject.

Mr. Lincoln further states that the voltage adjustment of any commercial machine is a gradual process, comparatively. I emphasized this point very strongly in my original letter, indeed insisted that a failure to recognize the relative meaning of the expression "rapidly changing flux" when used in this connection has been responsible for greatly overestimating the benefits received from laminating the frame.

In a paper on design of arc-welding generators (*Transactions A. I. E. E.*, Vol. XXXIX, Part 2) the writer has derived formulas for the transient currents of a separately excited differential generator when the resistance in the external circuit is suddenly changed from one value to another. As stated in the appendix to the paper, the formulas were derived on the assumption that in the sizes under discussion the mutual induction due to eddy currents in the frame is negligible, and yet the calculated values checked very well with values from oscillograms.

However, such analysis is not necessary, for the present at least, as Mr. Lincoln furnishes a good criterion for the usefulness of the laminated frame, namely, the extent to which it makes it possible to reduce the reactance in the external circuit. In the above-mentioned issue of the *Transactions* A. M. Candy of the Westinghouse company describes the operating characteristics of a generator having a solid frame (rolled), but in the design of which were embodied some special features tending to stabilize the arc circuit. The inductance used with this generator was given as 3½ millihenries at 100 amp. and approximately 2 millihenries at 200 amp. Furthermore, it was stated that the generator operated quite satisfactorily over a fairly wide range of current without any external reactance. Will merely laminating the frame permit the use of less inductance as a commercial proposition?

But that is not all. By the disposition of part of the commutating coil in the main pole flanges so as to obtain a large leakage flux interlinking with the coil considerably more inherent stabilizing effect can be obtained than was possible by means of the special features in the machine discussed by Mr. Candy. The writer fully agrees that prevention is better than cure, and inasmuch as the reactor at the best can only be considered a cure, I strongly recommended in my previous letter that designers concentrate their immediate efforts toward the elimination of the reactor. My opinion is that that can be done much more effectively by other means than laminating the frame, and so far the replies to my letters have in no wise tended to alter this opinion.

K. L. HANSEN
Milwaukee, Wis.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of
Generation and Distribution Equipment, and Methods of Economically Utilizing
Electric Service in Large Industrial Plants

Advantages of Scheduled Inspection Over Individual Responsibility

TWO methods are commonly employed by general managers and operating executives in checking the upkeep and repair of properties, the degree of efficiency maintained, the relative utility or obsolescence of equipment and the maintenance of said upkeep, efficiency and utility from year to year.

The first method, and the one commonly used by executives of the old school, is to place such responsibility once for all upon some appropriate individual, as, for instance, the plant superintendent, and consider the matter closed. The plant superintendent has several alternatives in handling this assignment. He may delegate the task to his assistant or immediate inferior in rank, who will in turn redelegate it on down the line, where it will eventually receive, perhaps, the thought and diligence of that employee least fitted by perspective, attitude or training to accept it. Each head from the chief executive down will be occasionally inspired to note some oversight, failure in effectiveness or dereliction of duty and will straightway prod his immediate delegates into activity and so on down the line. This is the so-called military type of management.

Proper Inspection Impossible by Disinterested Persons

We can say little for the disinterested and indifferent custodian who not only fails to delegate this duty to an individual whose characteristics fit him for such responsibility, but also fails to keep alert to the conditions himself. If his habit of mind continues, upon being confronted with conditions resulting from the absence of remedial and modernizing upkeep, his tenure of office is apt to be short-lived.

The "exceptional superintendent" to whom this assignment holds an especial appeal may pursue other tactics. His interest and sense of pride in the property may be reflected in his mental attitude to the extent of refusing to intrust this function of custodian to any one, least of all an inferior officer or employee. This type of executive pursues a similar course in other capacities and will usually be found overworked, harassed and burdened by each added duty or assignment. Each responsibility will doubtless receive honest, dependable treatment to the extent of his ability. In any event, assuming normal conditions, his plant and equipment will acquire the aspect of an efficient, well-maintained property.

Specific Instructions Necessary for New Employees

There comes a time eventually when the exigencies of industrial unrest (resulting in increased labor turnover), plant additions or other material changes or developments occur to add to previous burdens and necessitate a complete shifting of former adjustments. The new apprentices must find their places in uncharted ways, and there is a serious breakdown in the plan of operation that formerly functioned smoothly. Specific instructions to new employees must be stated and restated and followed up at high expense of time and energy, and even then the results of unexpected omissions constantly arise. Should the "exceptional executive" be absent at such a time, the result may be chaotic.

There is, however, another method in very general use but representing an entirely new school in executive thought and practice. It will not be adopted by the old "military type" executive or the "exceptional type" who aims to drive all the nails in his plant or property himself. It may be called scheduled inspection functionally maintained. A clearly defined task is set before each operating custodian. The schedule will state nothing that is in the least degree vague or indefinite, but on the contrary each task will be carefully and completely circumscribed. It will conform to Gilbreth's definition of a standard: "A standard is simply a carefully thought-out method of performing a function or a carefully drawn-out specification. The idea of perfection is not involved; it is simply the best that can be devised at the time the standard is drawn. Improvements in standards are wanted and adopted whenever and wherever they are found. There is nothing to preclude innovation. A proposed change is scrutinized as carefully as the original standard by as competent counsel. They are a constant invitation to experiment and improvement."

It is the recognition and acceptance of the above premises and the logical conclusions so afforded that we believe justify our confidence and persistent effort in attempting to render scheduled inspection increasingly effective in the operation of the Central Hudson Gas & Electric Company's system.

Few managers purposely neglect or postpone work essential to efficient maintenance of properties. There is a failure in bringing to attention needed changes and repairs, a lack of system in directing the inquiry, and an absence of follow-up treatment in pursuing the subject through to completion.

Inspection May Be Supplemented by Outside Forces

Schedule inspection is a resultant of two viewpoints—staff and line. In application it may be supplemented by expert "outside inspection" services in addition to the occasional managerial survey and regular insurance inspection. In relation to upkeep a man exclusively detailed to handle minor plant repairs and construction orders may often be used to advantage.

A schedule is impersonal and consequently more amenable to criticism and review than the best-intentioned custodian; it is insistent upon comprehensive treatment regarding each item of its check list; it may not be unduly postponed, since it is sub-

ject to immediate and imperative "follow-up."

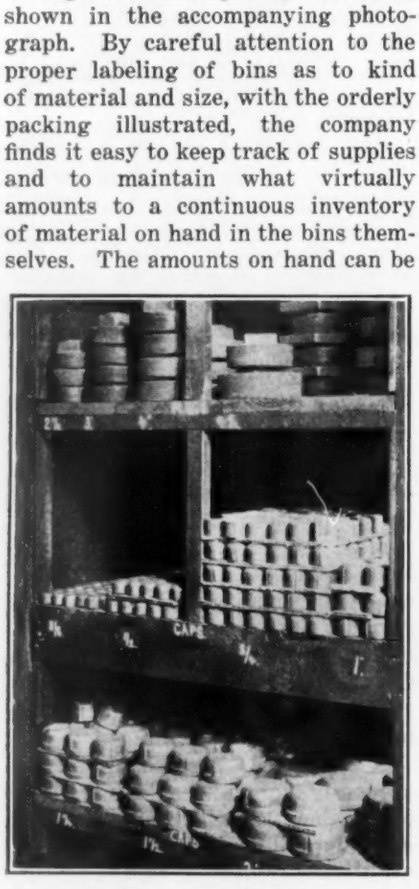
The scheduled method is, in our opinion, strong in precisely those elements where the method of responsibility minus adequate written instructions, report and follow-up is weak. It is regular and prompt where the older method is at best occasionally delayed through pressure of seemingly more important duties. It is independent of personnel where change in the latter may prove disastrous. It may well be, however, that susceptibility to improvement is its main attribute and that even where present schedules may prove inadequate they will at least afford a basis upon which more consistent practices may be subsequently established and from which better results will accordingly ensue.

E. W. BAKER.

Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.

Spacers Aid Storage of Parts in Stockroom

MATERIAL in the stockroom of the Stamford (Conn.) Gas & Electric Company is stacked in unusually compact order by the use of corrugated-board spacing sheets, as shown in the accompanying photograph. By careful attention to the proper labeling of bins as to kind of material and size, with the orderly packing illustrated, the company finds it easy to keep track of supplies and to maintain what virtually amounts to a continuous inventory of material on hand in the bins themselves. The amounts on hand can be verified with the utmost rapidity by multiplying the numbers of units in each row by the number of rows and this product by the number of tiers. The entire stockroom presents the appearance of the small section photographed.



INVENTORY OF STOCK FACILITATED BY CORRUGATED SPACERS

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Roller Bearings Reduce Mill Motor Maintenance

MARKED reductions in mill motor-bearing troubles have resulted from the use of roller bearings in this type of equipment, according to a paper recently presented before the Philadelphia section of the Association of Iron and Steel Electrical Engineers by L. J. Hess, chief electrician Youngstown (Ohio) Sheet & Tube Company. Mr. Hess has done much original work along the line of roller-bearing design for mill motors. His first installation of roller bearings was made on a Westinghouse series crane motor on hoist service about six years ago. The bearings were of the spring-roller type, but the design was unsuccessful, owing probably to lack of study of the problem and to the transition through which bearing design was passing in this establishment.

ROLLER BEARINGS USED TO ADVANTAGE ON HOT-METAL CRANE

About four years ago another installation was made of a solid roller-type bearing on a Crocker-Wheeler size EW series motor driving, in tandem with a similar motor, the bridge of a 100-ton hot-metal crane in a mixer building. Previous to this application, a four-month run on babbitt bearings on this drive was considered good, while frequent armature changes, broken bands and flat spots were the rule. At the time of the application the commutator was badly worn, had an estimated life of three months with babbitt bearings, and rewinding was close at hand. After the roller bearings were installed the motor ran about nine months before the commutator began to throw bars. Electrical repairs were then made, and the bearings have since been running without trouble either in armature or bearings. No grease or oil has leaked into the windings or upon the commutator, and a recent inspection shows a bearing wear of only about 0.004 in., which is the ordinary tolerance for a new babbitt bearing.

By making a new motor head Mr. Hess developed a roller bearing which has given excellent results in the Westinghouse type K motor. This involved a comparatively small casting and eliminated difficulties formerly experienced with the bronze sleeve-type bearing. At present roller bearings have been developed for the Crocker-Wheeler type SM, sizes CW, DW, EW and FW, and the Westinghouse type K, Nos. 3, 4, 6 and 8 frame motors. These bearings the Youngstown company carries in stock, and as fast as the repairs to armatures necessitate new shafts and the repair record of the motor indicates the necessity of roller bearings they are put on. Besides careful design of shafts and bearings, heat treatment of shafts is also desirable in order that the surface may be harder and tougher to withstand the action of the race. Using a steel with 0.50 per cent carbon, quenched in oil at 1,500 deg. and drawn back to 850 deg., a shaft is obtained which is tough and moderately hard, with the added refinement of grain and improvement of the breaking strength.

From experience with about sixty sets of bearings, Mr. Hess has found the following advantages:

1. Electrical repairs to commutators and windings are greatly reduced because at least 50 per cent of these troubles arise from oil and grease working upon the commutator and front V-ring.

2. Commutator wear is materially reduced because there is no jumping due to loose bearings with resultant flashing and flat spots.

3. Equalizer connections are relieved of abnormal duty because the armature is held constantly in the center of the magnetic field.

4. Broken bands due to rubbing are unknown.

5. Pinions are kept accurately in mesh and crowding of teeth is obviated.

6. Inspection cost is reduced through improved commutation and less attention to lubrication.

7. The cost of lubricants is reduced almost to nil, as the bearings consume practically no grease.

8. Labor and lost time during armature changes and charges against electricians in mills are reduced.

The writer stated that in ordering a considerable number of mill motors he would specify roller bearings.

In the discussion the desirability of permitting further time for standardization of bearings to be effected in designing circles was brought out.

D. M. Petty, superintendent electrical department, Bethlehem Steel Company, Bethlehem, Pa., predicted that in the near future either ball bearings or roller bearings for motors will be the rule rather than the exception. Ball bearings on a 20-hp. shear motor with pinion drive have been running over two years, against a sleeve-bearing life of three months. The importance of adequate size in ball bearings was also brought out in the discussion.

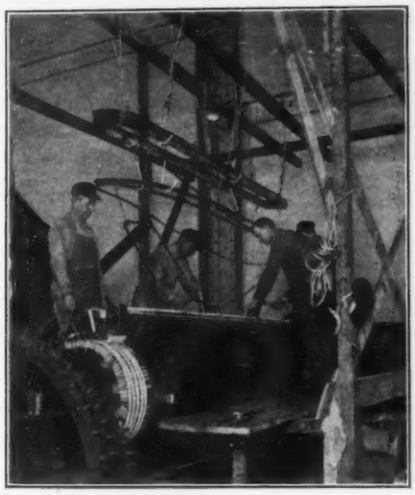
FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

A 30,000-Kw. Rotor Rewound in 74 Days

WITHIN seventy-four days after an opened field coil was found on a 30,000-kw. generator in the Connors Creek plant of the Detroit Edison Company the entire field was rewound and the machine back in service. This 1,800-r.p.m., 12,200-volt unit had been in operation since June 11, 1920. Trouble was first experienced on Aug. 18, 1922, when it was found that after the unit was brought up to speed there was no voltage on the stator.

After removing the end bells it was found that the field connections between poles had broken. When the machine had been shut down in cooling off, the ends of a coil had separated, causing an open circuit. Since the installation of the coils and the wooden spacers showed excessive heating, it was decided to rewind the entire field. The first work was to sledge out 480 brass and iron wedges, which was accomplished in about a week's time with very little damage to the wedges.

In lifting out the coils they were twisted and bent out of shape very badly, as the slot insulation was baked hard and had stuck to the coils and slots. The coils were then annealed before they could be straightened. As there was no convenient means of obtaining more than 900 amp. at low voltage, a blow-torch was used which annealed only the ends. It was then necessary to make a press to straighten the coils and flexible connections were connected to the ends.



RELAYING-COIL METHOD FOR REINSERTION IN ROTOR

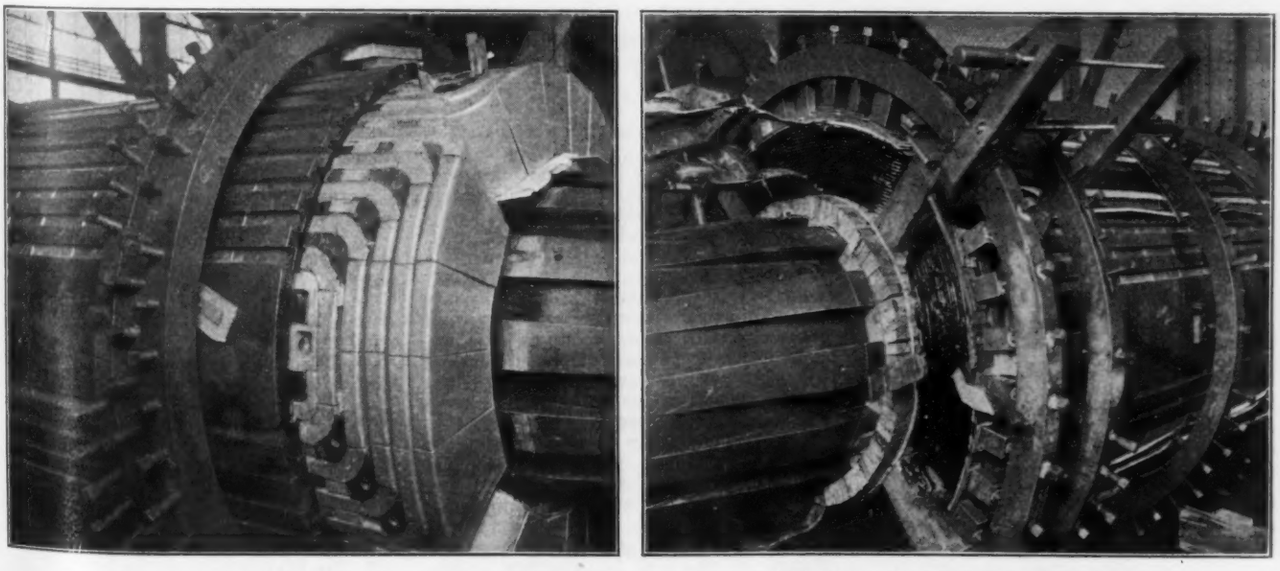
The coils were then insulated with mica tape wound by hand, and each turn was varnished as it was wound. The method of relaying a coil when being replaced in the rotor is shown in one of the accompanying illustrations. A new cell was placed in the iron slot and each turn of copper dropped in place and then driven in with fiber boards and rawhide mallets. The inner coil, being the hardest to place owing to the short radius of the end turns, required a 90-deg. twist in each end to slip it over the core, but when in place this twist was hammered out.

Pressure rings were used in forcing the upper coil into place, and current was applied to warm the insulation to make it more pliable. The twenty coils had each to be heated and pressed separately, then the entire field was baked for five days. Aluminum pins were used in securing the end turns instead of wooden blocks because, besides holding the insulation in place and preventing its mushrooming from centrifugal force, they carry the heat to the retaining bells, where it is dissipated. After the retaining bells were replaced the field was again baked for a period of four days and then placed back in the armature. The repaired unit started to generate electricity again on Oct. 31, 1922. The total time required to complete the work was equivalent to 11,855 man-hours.

A. N. SIMMONS.
Detroit Edison Company,
Detroit, Mich.

Control of Direct-Current Generator Fields

RECOMMENDED practice for the control of direct-current generator fields as adopted by the Electric Power Club shall be to omit field switches from direct-current generator panels, it being understood that



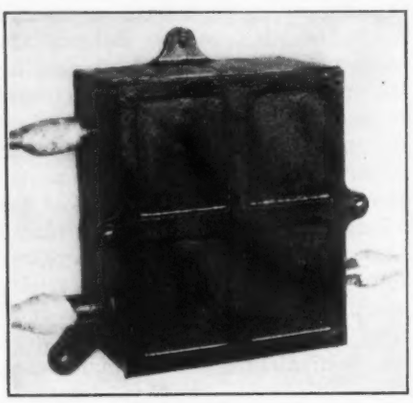
LEFT—FIELD ALUMINUM SADDLE AND WEDGES ON END TURNS OF 30,000-KW. ROTOR AT CONNORS CREEK BEING DISMANTLED. RIGHT—PRESSURE RINGS AND CURRENT AID IN FINAL ASSEMBLY

when no field switch is used the field rheostat will be designed to reduce the field current to a point which will not allow the building up of voltage on the generator.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Reliable Operation Insured by Solenoid Switch

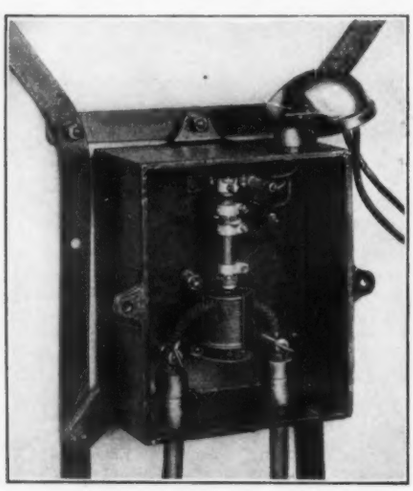
A SWITCH that has proved very useful in connection with the operation of illuminated traffic signals at street intersections has been developed by the United Electric Light Company of Springfield, Mass.



MOISTURE-PROOF BOX USED WITH OR WITHOUT HANGERS

These signals contain two 50-watt mill-type "Mazda C" lamps, operated from 110-volt alternating-current circuits. The switch is installed in a manhole and connected to the series street-lighting circuit, which insures regular operation of traffic signals.

This switch consists of a stationary contact and a movable contact, the latter being brought into contact with the former when the solenoid is energized by the high-voltage circuit. The contact is thus held until such time as the high-voltage circuit is cut off, when the contact is broken by gravity. The magnetic circuit of the solenoid contains a large leakage path, so that a quick break follows the cutting off of the current from the series coil.



SOLENOID SWITCH ADAPTABLE TO UNDERGROUND AND OVERHEAD SERVICE

The contacts and solenoid are mounted on an insulated panel of non-hydroscopic material and inclosed in a cast-iron box, such as is shown in the accompanying illustrations. The cover of the box is fitted with a lead gasket, and the cables are brought in through brass sleeves wiped on, making the box moisture-proof, so that it may be installed in any desired location. The switch box is 8 in. long by 10 in. wide and 4 in. deep, fitted with three lugs for attaching to the wall of the manhole. The box may also be fitted with hangers for installation on cross-arms when used with overhead construction.

L. O. INGALLS,
Electrical Engineer.
United Electric Light Company,
Springfield, Mass.

Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

General Switching Recommendations

IN SWITCHING operations speed is desirable, especially in cases of emergency, but unless an operator is absolutely sure of every move he makes rapid manipulation of switches may serve only to increase rather than diminish the trouble. The best indication of the correct performance of switching operations is obtained by intelligently observing the ammeters during the switching. For example, when one transformer bank is carrying a certain load its ammeter indicates the amount of current. If another transformer bank is connected in parallel with the first one, the two banks should divide the load in proportion to their capacities and their ammeters should indicate this division of the current.

In order that switching operations may be facilitated the Philadelphia Electric Company employs the following rules:

1. The operator should always know with certainty the proper steps to take in switching of any kind, and his moves should always be made with his attention fixed upon what he is about to do.
2. Ammeters and pilot lights must always be observed when performing any switching operations.
3. In case of trouble proceed as rapidly as accuracy permits and carry out a definite plan thought out in advance.
4. Consult the load dispatcher before carrying out any switching operations on the system under his control, except where delay will result in danger to life or property. In this emergency the operator may proceed with such operations as he thinks necessary and report to the load dispatcher immediately afterward.
5. All switching, when possible, should be checked by another person in company with the one performing the switching operations.

Rules for Changing Shifts in Boiler Room

WHEN changing shifts in a stoker-fired boiler room it is necessary for the incoming shift to report before the outgoing shift leaves in order to determine existing conditions so that the water tender or boiler operator may assume full responsibility for immediate operation even under the most unusual conditions.

Special attention should be paid to the report on the automatic feed-water regulators since the sticking of these valves will either flood the boiler or let it run dry. The specific rules in regard to changing shifts followed by the Philadelphia Electric Company are given below:

At the beginning of each shift, before taking over the shift, the water tender or boiler operator must proceed as follows:

1. Blow down the working column and gage glass on each boiler and test the gages by opening the gage cocks to determine the water level.

This should be done by the water tender or boiler operator, but any one else detailed may blow down duplicate columns under supervision of the water tender or boiler operator.

2. Examine the fires and see that the stoker speeds and drafts are adjusted properly for the ratings developed. Note the position of wind box extensions, clinker-crusher doors and clinker-crusher speed.
3. Examine the gage board to see that all instruments are in operation.
4. The water tender or boiler operator leaving the shift must report to his relief any unusual or special conditions pertaining to the apparatus and fires. Special attention must be given in this report to the condition of the automatic feed-water regulators and hand-operated feed-water valves.
5. On taking over the shift the water tender or boiler operator assumes full responsibility for further operation.

"Fool-proof" Disconnecting Switch

Electrical Interlock in 66,000-Volt Outdoor Switching Station Prevents Opening Under Load, While 45-Deg. Mounting Maintains Safety Factor of the Insulators

SIMPLICITY in bus structure, with lack of complicated wiring, has been insured in the 66,000-volt outdoor switching stations of the Duquesne Light Company by the use of the specially designed, gang-operated disconnecting switch shown in the accompanying illustrations. Other advantages gained by use of this switch are:

(a) It may be electrically or mechanically interlocked with the accompanying oil switch to prevent opening under load.

(b) It may be mounted high up on the structure when structural features of substation design make this desirable.

(c) Complete isolation of an oil switch may be effected in a few seconds, whereas the operation of six single-pole units with a long hook stick may take several minutes when time is very valuable during an emergency.

(d) The operating handle may be grounded and thus eliminate the danger from a switch hook stick becoming a partial conductor.

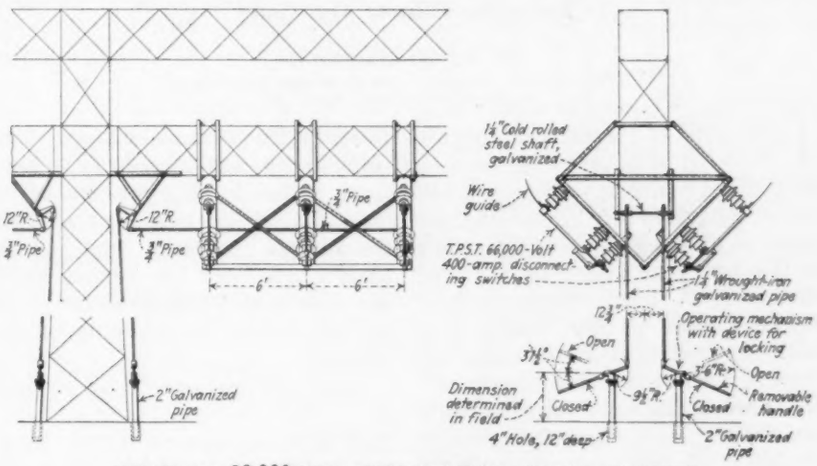
(e) The operating handle may be locked in either the open or closed position.

The interlock between oil circuit breaker and disconnecting switch is obtained by the following sequence of operations: Under normal conditions a key remains continuously inserted in a lock on the switchboard, permitting operation of the oil circuit breaker by means of the controller or by relay action. When the oil circuit breaker is to be inspected or repaired the key is removed, tripping the breaker (if this has not already been done) and opening the closing circuit to prevent reclosing. The key is then used to unlock the disconnecting switches, which are then opened manually, the padlock being replaced in such a way that they are also locked open. Upon completion of repairs the disconnecting switches are closed and the key is again inserted in the lock at the switchboard, permitting normal operation of the oil circuit breakers. Instead of installing the lock on the switchboard, it may be installed in the oil circuit breaker control housing, which would have certain advantages in a large outdoor station.

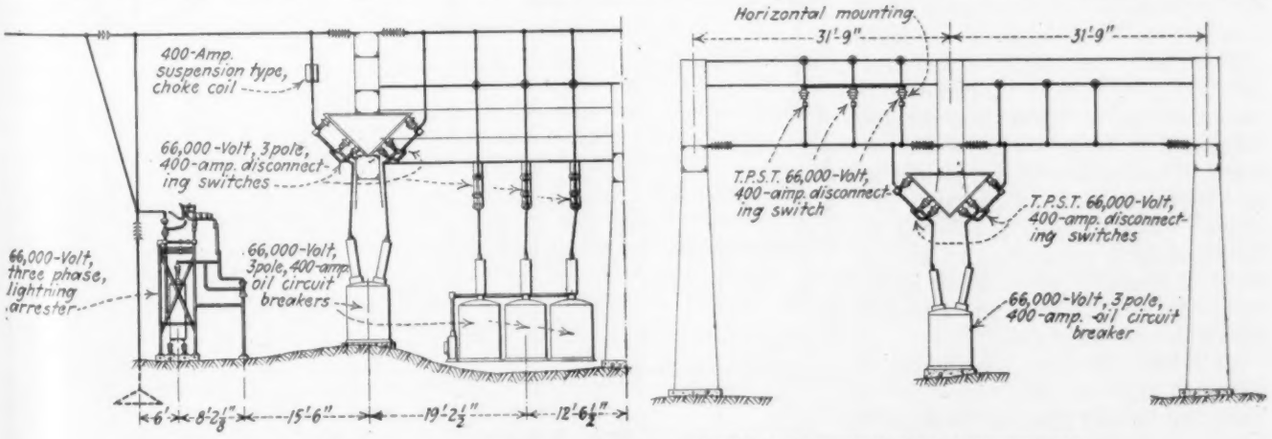
The switch shown has a special rotating mechanism which permits mounting at any angle desired. With the base mounted at 45 deg. to the vertical, taps to the bus can be made short and direct, and the absence of turns and bends in the switch and transformer wiring permits the use of ordinary stranded conductors and standard suspension insulators and hardware. To secure the angular mounting the base is framed into the steel structure, thus eliminating castings in the insulator supports. By slightly modifying the steel structure horizontal or vertical mounting can be obtained.

The switch has been adapted for use with 22,000-volt and 66,000-volt lines, and in the substation shown the same design of switch, with various ratings, has been used on both the high-tension and the low-tension sides of the transformers.

Similar switches for 22,000-volt structures have been employed in one of the substations of the West Penn Power Company. These switches also bring out the advantage that gang operation eliminates difficulties from extreme mounting heights and at the same time facilitate the construction of buses from standard line material.



DETAILS OF 66,000-VOLT DISCONNECTING SWITCH, SHOWING OPERATING MECHANISM



TYPICAL APPLICATIONS OF INTERLOCKED SWITCH TO 66,000-VOLT SUBSTATION CONSTRUCTION

L. C. PETERMAN,
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Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Development of Electrical Advertising

Data from 143 Cities Show Wide Variation in Use, but a Uniformly Large Opportunity Exists for More Business If Energetic Efforts Are Made

By H. H. Magdsick
Chairman Sign, Display and Billboard Committee, Commercial Section, N.E.L.A.

THE rate of increase in the use of electrical advertising through more and larger displays and the substitution of higher-wattage lamps in existing signs was previous to the last year about 15 per cent annually. A much faster growth was evidenced during 1922. This has been attributed to two major influences: First, publicity managers are appreciating more fully the many advantages and the comparative efficiency of this medium and are appropriating a constantly growing part of their advertising budget to it; second, central station commercial managers are realizing more generally the desirable and profitable nature of the electrical advertising load and are joining in organized stimulation of the field.

Surveys conducted by the Lighting Sales Bureau of the National Electric Light Association have brought out clearly the opportunity for increasing central-station revenue by the promotion of electrical advertising. One hundred and thirteen central stations assisted in a recent survey by furnishing detailed information from their cities, and sign manufacturers supplemented this with data from thirty other cities. These surveys reveal some interesting facts regarding the development of electrical advertising in the 143 cities, which have an aggregate population of 6,300,000.

In Table I, showing the number of different types of displays, it is interesting to note that of the 250,000 listed 112,000 were exposed lamp signs and 81,000 were inclosed lamp signs. That is, 77.2 per cent of the total was purely electric advertising. Illuminated bulletin and poster boards accounted for 50,000, or 20 per cent, and 7,000 displays, or 2.8 per cent, were for building outline lighting.

These 250,000 electrical displays, as shown in Table II, have a total of 15,000,500 sockets, in which lamps varying in size from 5 watts to 250 watts and even larger are used. The average wattage per socket is 13.2. The largest sign has a connected load of 300 kw. and 20,000 sockets, the average connected load is 800 watts with sixty sockets, and the smallest is 25 watts in one socket.

In addition to the tabulated information shown here, the surveys have emphasized some fundamental facts with regard to increasing the use of electrical advertising:

1. The opportunities for development are relatively the same in cities of all sizes. In large cities and small cities organized sales effort has succeeded equally well in promoting a high per capita use, and it is also true that lack of stimulation has everywhere resulted in a lower use of this medium.

2. The opportunities exist in all

TABLE I—TYPES OF ELECTRICAL DISPLAYS

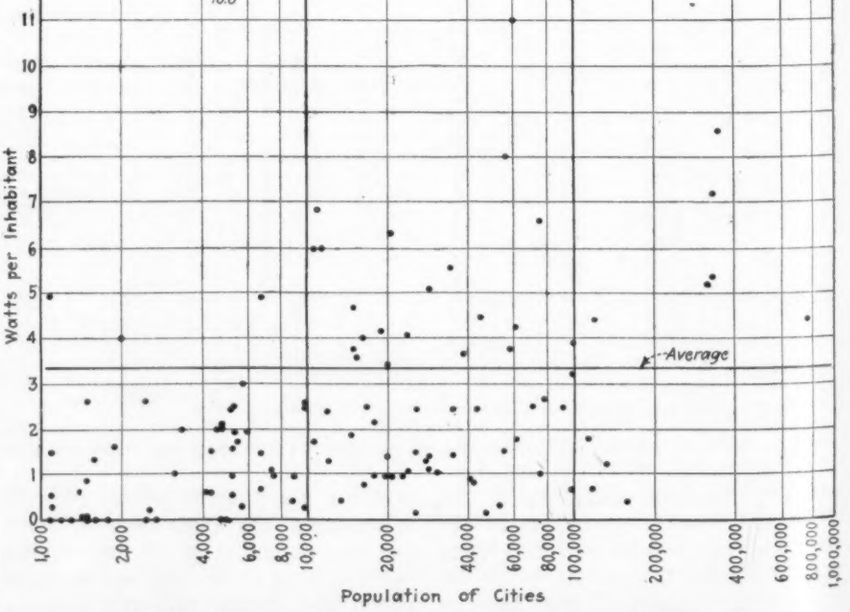
Exposed lamp signs	112,000
Inclosed lamp signs	81,000
Bulletin and poster boards	50,000
Building outline and marquise lighting	7,000
Total	250,000

TABLE II—LAMP SIZES AND CONNECTED LOAD OF SIGNS AND DISPLAYS

Lamp Size, Watts	Per Cent of Total Lamps	No. of Lamps	Kw. Connected	Per Cent of Total Wattage
5	39.2	5,860,000	29,300	14.8
10	43.8	6,680,000	66,800	33.2
15	3.0	448,000	6,700	3.4
25	7.4	1,108,000	27,600	14.0
40	0.5	81,000	3,240	1.6
50	3.2	471,000	23,500	11.9
60	0.3	38,000	2,280	1.1
75	0.6	89,000	6,700	3.4
100	1.5	160,000	16,000	8.0
150	0.2	34,000	5,100	2.6
200	0.3	52,000	10,400	5.2
250 and larger	0.2	24,000	1,200	3.0
Total	....	15,005,000	198,820	....

Average 13.2 watts per socket
Largest display has a connected load of 300 kw. and ..... 20,000 sockets
Average display has a connected load of 800 watts and ..... 60 sockets
Smallest display has a connected load of 25 watts and ..... 1 sockets

Note—Use of 5-watt lamps is decreasing rapidly, while use of the 15, 25 and 50-watt sizes is increasing.



ELECTRICAL ADVERTISING IN WATTS PER INHABITANT IN 143 CITIES

sections of the country. Again, it is found that North, East, South and West respond enthusiastically wherever organized effort is made.

3. In industrial and commercial cities, trading centers and agricultural districts, summer and winter resorts, and cities of all types, this medium is effective and has been used extensively whenever vigorously offered.

TABLE III—CLASSIFICATION OF CHIEF USERS OF ELECTRICAL ADVERTISING

	No. of Sockets
1. Theaters (motion-picture and legitimate)	2,680,000
2. Automotive (sales offices, garages, oil stations)	1,500,000
3. Restaurants (cafés, lunch rooms, etc.)	1,290,000
4. Clothing (stores, tailors, cleaners, etc.)	1,280,000
5. Hotels (rooming houses, etc.)	1,260,000
6. Banks (investment houses, etc.)	780,000
7. Drugs	700,000
8. Shoes (stores, repair, etc.)	385,000
All others	5,000,000

4. The actual development in specific cities of all sizes and districts, however, does vary directly with the efforts at promotion put forth. The average development as shown in the accompanying chart is equivalent to 3½ watts per inhabitant, corresponding to an energy consumption of about 5 kw.-hr. annually.

It is usually assumed that the greatest development of the sign and display load is found in the larger cities. This is true only to the extent that selling effort has been better organized. In the small cities the development may be as high or higher when proportional effort is made. The average of 3½ watts per inhabitant is weighted according to population and not according to number of cities. Some cities report only 0.1 watt per inhabitant, while other cities show 10 watts per inhabitant or more. If the development is brought up to that already obtaining in the best 10 per cent of the cities, the central-station revenue from electrical advertising will be increased from its present figure of $15,000,000 to $35,000,00.

Three Exclusively Electric Garages for New York

IN ANTICIPATION of a great increase in the use of electric trucks in New York during the next two years garage managers are making substantial enlargements in their service facilities and at least one stable, recognizing that the days of the horse-drawn vehicle are numbered, is being converted to a garage. In the stable of the Wendall & Evans Company, which had room for two hundred horses, the stalls are being removed, new floors laid, and when the alteration is completed there will be facilities for garaging 175 electric vehicles. This garage will handle electric vehicles exclusively.

The Commercial Truck Company also has leased a large building on Nineteenth Street, and when alterations are completed it will operate a service station and garage with accommodations for 150 trucks. The Walker Vehicle Company has outgrown its present quarters in Long Island City and has just given contracts for the erection of a new building. The garage will occupy a plot 100 ft. x 100 ft., will be three stories high, with 30,000 sq.ft. of floor space, and will be able to care for 350 electric trucks.

Chicago Electric Shops Break Sales Records

TOTAL appliance sales by the Commonwealth Edison Company for the last year smashed all former records established in the company's branch stores. Not only did the total sales for 1922 far exceed those of any other year, but in December they were greater than during any previous month in the history of the company, and on one day during the month the previous high day's record was passed by more than $10,000.

Perhaps the most remarkable fact about this last feat was that the day on which the record was made was selected in advance, so that the record breaking was no chance happening, but the result of an efficiently planned campaign.

E. A. Edkins, general manager of electric shops, selected Thursday, Dec. 21, as the day. Careful preparations were made a week in advance. Mr. Edkins held a meeting of all the salespeople in the electric shops, explaining to them the purpose of the plan, and asking them to work at more than top speed on that day. He also interviewed the branch store managers, the outside salesmen, the supervisors, the cashiers and the credit department, enlisting their co-operation.

The result of this excellent planning was that on the day chosen a total of $51,700 worth of merchandise was sold. The previous high record, made in December, 1920, was about $40,000. Mr. Edkins is enthusiastic over the manner in which the employees in his department and those working with that department responded to his request.

"Credit for the accomplishment," he said, "must go to all the people who are concerned in the drive. It was only by the co-operation of the salespeople in all of the stores, the outside salesmen and the cashiers that we were able to do it."

Although the figures are not yet complete, indications are that the sales for December reached the high mark of $540,000, and that the total gross sales for the year 1922 were more than $3,500,000, about $300,000 more than the previous high year, 1920.

Customers Have Choice of Rates in New Schedule

STEPS have been taken by the British Columbia Electric Railway Company, Vancouver, B. C., to differentiate between domestic and commercial customers under a new lighting schedule put into effect on Jan. 1. Under an agreement with the City Council of Vancouver by which the street-railway franchise was altered to allow the company a 6-cent fare and other adjustments, the company agreed to reduce the domestic lighting rate from 6 cents to 5 cents a kilowatt-hour.

There are about five thousand commercial lighting customers in the city, including a large number of small offices, small stores or combination stores and residences. The company has offered to its commercial customers the 5-cent lighting rate, but with a minimum charge of $1 per month per kilowatt-hour connected. Schedules have been mailed to every customer to be filled in, and these will be checked by the company during the year. The domestic minimum charge is 50 cents per month.

On the other hand, if any commercial customer, such as the small office or store, does not wish to pay the minimum charge of $1, he may continue to pay 50 cents a month minimum, but his rate for energy will be 6 cents a kilowatt-hour. Most of these small customers have an extremely low load factor, using light only for an hour or two a day and only in winter. This is the company's reason for making a higher charge to such customers than to residences.

Another feature of the Vancouver rates is the differentiation between the center of the city and the suburbs. Vancouver proper covers a small area, whereas one-third of the

population of the greater city resides in self-governing municipalities. These municipalities must make separate agreements covering utility services. Several years ago the company made a greater reduction in the city than in the suburbs, and today the domestic rate in the latter is 7 cents a kilowatt-hour, with possibility of a reduction if agreements are negotiated with the respective municipalities.

Analysis of Residential Load Conditions

BY J. A. ROCKWOOD
Valuation Engineer Portland (Ore.) Railway, Light & Power Company

INCREASES in the use of electrical energy in the home have been one of the interesting features of electrical progress since the war, and a recent analysis by the Portland Railway, Light & Power Company reveals conditions which are typical in many companies.

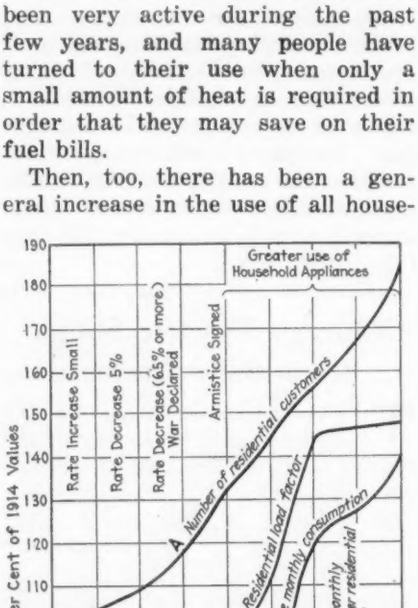
Up to November, 1918, there had been relatively little change in the amount of energy used by the householder, but in December, 1918, there was a marked increase in the average residential consumption in comparison with the same month of the preceding year. In January, 1919, there was an even greater increase per customer when compared with January, 1918. It was first thought that there must be some unusual cause back of such a noticeable increase, but it is now evident that this is a permanent condition. The consumption per customer has mounted steadily until now it is about 65 per cent greater than in 1918.

The earnings per customer also have increased, but not in the same proportion as the kilowatt-hour consumption. The increases in revenue have averaged about 30 per cent between 1918 and 1922. Owing to a sliding scale the average rate per kilowatt-hour has decreased about 20 per cent. These changes in unit figures make it plain that there has been a decided increase in the use of electrical energy by the average residence consumer, and the accompanying curves express these changes graphically. It will be noted from the chart that no changes in rates have occurred since the middle of 1916.

A part of the increase is due to the growing popularity of the electric range. There are now about 1,600 electric ranges on the company's system, but it is significant to note that very few of these were being added during the period that the greatest increase occurred. It is therefore evident that a large proportion of it is due to the use of other electrical appliances, especially small portable heaters used to supplement the regular house-heating system.

The sale of these heaters has been very active during the past few years, and many people have turned to their use when only a small amount of heat is required in order that they may save on their fuel bills.

Then, too, there has been a general increase in the use of all household electrical appliances. This has been caused partly by the convenience-outlet campaigns that have been carried on in all parts of the country and partly by the public having become more fully convinced of the convenience and economy of electric service. Another factor has been the tendency toward better illumination in the home, which is reflected in greater consumption and has more than offset the expected decrease because of the more efficient "Mazda" lamp. The sudden increase noted in December, 1918, was no doubt the result of a relaxation from the economies practiced during the war, although, as will be noted from the curves, these economies did not result in any serious decrease in the average consumption during the war.



AVERAGE RESIDENTIAL CONSUMPTION IN PORTLAND, ORE.

What Other Companies Are Doing

Worcester, Mass.—In one month a single representative of the Worcester Electric Light Company, covering on foot the outlying districts of the city, sold 446 lamps from a portable supply to small storekeepers, distribution being by hand. Of these, 217 were sold to increase the illumination of existing installations, the increase in connected load being from 10,220 watts to 16,850 watts. Many of the remaining sales were to fill empty sockets or to replace burned-out units. Edwin Mandeville is in charge of the commercial lighting department.

Salt Lake City, Utah.—In the year ended Nov. 30, 1922, the employees' mutual aid association of the Utah Power & Light Company paid death claims amounting to $3,700 and sickness, accident and refund claims to members totaling $2,550. A surplus of $7,967 was divided among 826 members of the association, prorated according to the length of membership. Employees who were members throughout the year each received $10.25, the largest dividend ever paid by the association.

Hartford, Conn.—A compact calendar for the new year has been prepared by the Hartford Electric Light Company, carrying each month a practical message to the customer about the convenience and economical use of electric service. The calendars are mounted on cards only 3⅜ in. x 6¼ in. in size, and, instead of featuring the company's name, emphasis is placed upon the value of electricity as a servant. Suggestions are given monthly on cleaning lamps, fuses, metering, extra switches, wages of the electrical servant, repair service, the porch light, hot-weather comforts, electric heaters, lamp renewals, glare and lamp selection.

Poteau, Okla.—The first of a series of employees' meetings of the Oklahoma Gas & Electric Company was held at the Poteau office on Jan. 4. These meetings are planned to be held every two weeks and will alternate between this town and Heavener. Their avowed object is to discuss ways and means of improving service rendered the company's customers. Entertainment features are planned in order that they may be made as attractive as possible.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydraulic Turbines for Very Low Falls.—F. JOHNSTONE-TAYLOR.—Owing to the attention being bestowed on the development of even quite small water powers and the necessity of developing water-power resources to the utmost, irrespective of the available fall, considerable attention is being paid to the low head turbine. The result is that these water turbines have now reached a high state of efficiency and are being built of a type which is suitable for driving all kinds of electric generators. —*Electrical Times*, Nov. 23, 1922.

The Hydro-Electric Power Station at Fully, Switzerland.—The working of hydro-electric power stations in the Alps, which are operated by water courses fed by glaciers, is entirely dependent upon the quantity of water available. Low water occurs in the winter, and tl. periods of high water are in the summer months. At low water the flow is generally much below the average, and when the equipment of the stations does not include steam reserves as a standby power the output may fall to very low limits during the winter. A means for overcoming this difficulty is the provision of water reservoirs at a high level, and one of the most interesting examples of a power station under such conditions is the one at Fully, Valais, Switzerland, which operates under a head of 1,650 m., this probably being by far the highest working head ever utilized. The building of this installation, including the power house, turbine foundation, pipe lines, etc., was surrounded by very many difficult problems, and a detailed description of the manner in which these were overcome is given. The pipe line connecting the reservoir with the plant is 4,625.5 m. long and is made of welded pipes varying in thickness from 6 mm. to 20 mm. It is operated at pressures up to 60 atmospheres. Four turbo-generators are used. These are designed for a flow of 200 liters per second at minimum head and for a normal power of 3,000 hp. each. The turbines operate at a normal speed of 500 r.p.m. — *Engineering*, Nov. 24, Dec. 1 and Dec. 15, 1922.

Generation, Control and Switching

Improvements of Power Factor.—GISBERT KAPP.—This posthumous paper, presented before the Institution of (British) Electrical Engineers on Nov. 16, 1922, deals with the use of such consuming devices, or such addition to existing consuming devices or apparatus, as will improve the operating power factor of a plant. The paper is divided into three parts. The first part deals with the economical limit of power-factor improvement in relation to capital outlay. The concluding pages deal with meters and tariffs which allow the effect of a consumers' power factor to be assessed in money. Various methods of indicating kilowatt maximum demand and wattless kilovolt-amperes are described, and particulars of the tariffs employed by companies in England are given. The middle section of the paper, which is by far the longest, describes the equipment which can be used for power-factor improvements and brings together a useful amount of critical information on rotary and static condensers, synchronous induction motors, rotary converters and phase advances in their application to the correction of power factor.—*Electrician*, Dec. 1, 1922, and *Engineering*, Nov. 24, Dec. 1 and Dec. 8, 1922.

Transmission, Substations and Distribution

Factors Affecting Bulk Underground Transmission.—P. DUNSHEATH. — Two possible methods of transmitting large amounts of power underground are discussed. These are (1) direct-current systems and (2) alternating-current systems using a multi-core cable or single-core cables. Some of the problems encountered are common to each of the systems, but each system has its own peculiar points, and the recognition of these without arriving at adequate methods of handling them has resulted in a curious state of affairs in which different engineers select totally different systems for practically identical conditions. Some of the systems described are the 110,000-volt line of the Metropolitan Electric Supply Company (England), using single-core cables; the 60,000-volt single-phase transmission line used in connection with the electrification of the St. Gothard system between Switzerland and Italy, in which single-core cables are used, and the 50,000-volt line of the Union d'Electricité, Paris. The author considers sheath losses, longitudinal current losses, the effect of armoring, dielectric losses, thermal characteristics, etc., of the types of cables now in use in Europe.—*Electrician*, Dec. 1, 1922.

Japanese High-Voltage Power-Transmission Systems.—S. W. HAYES.—Super-power systems in the United States have been thoroughly discussed in the American technical press within the last few years, but little has been published about similar developments in other countries. Japan's progress in high-voltage transmission is of interest. In this article, the first of a series, the author takes up some of the more general features in connection with the larger power transmission systems and then goes into further details relative to interesting features of the generators, transformers, synchronous condensers, switching equipment and other important devices. — *Electric Journal*, December, 1922.

Units, Measurements and Instruments

Thermionic Voltmeter.—The vacuum tube forms a convenient method of measuring alternating electromotive forces of any frequency, because, owing to its asymmetric conductivity, an alternating electromotive force of which the mean value is zero produces an alternating current the mean value of which is not zero and which is readily measured by an ordinary milliammeter or microammeter. Two methods of using the triode valve as a rectifier are described. One method employs the curvature of the anode current/grid potential characteristic, while the other employs the curvature of the grid current/grid potential characteristics.—*Engineer*, Dec. 15, 1922.

Testing of Materials Used in the Manufacture of Electrical Equipment. —C. DAWSON.—The tests on metals that are described are tensile, compression, shearing, bending, torsion, impact, hardness and magnetic. For sheet and molded insulation the following tests are described: Mechanical strength, plastic yield, electric strength and insulation resistance; for oils, electric strength, insulation resistance, viscosity, flash point, chemical reaction and sludge, while for varnishes the tests described include electric strength, flexibility, acidity and time necessary for drying.—*Journal of the Institution of (British) Electrical Engineers*, December, 1922.

Illumination

Lighting in Factories and Workshops.—The third report of the Home Office departmental committee (England) marks a new stage in the treatment of the above subject. The two previous reports are first summarized. The primary recommendation contained in the first report stated that there should be a statutory provision in general terms requiring adequate and suitable lighting in every part of a factory or workshop and giving power to the Secretary of State to define such lighting. In the second report general requirements in regard to avoidance of glare, elimination of inconvenient shadows and absence of flicker were made. In the report recently issued the requirements in regard to glare are supplemented by an indication that when a brilliant source is covered by a small shade the brightness may considerably exceed 15 cp. to 20 cp. per square inch and should be treated as a source and its position with regard to the worker limited accordingly. The chief question

considered in the third report is the degree of illumination needed for the actual carrying on of work. The committee presents a comprehensive schedule of industrial operation, divided into two classes described respectively as "fine work" and "very fine work," the former requiring 3 foot-candles and the latter about 5 foot-candles.—*Illuminating Engineer (London)*, Vol. 15, No. 7.

Motors and Control

Flour-Mill Electrification. — The power employed in the flour industry in Canada is shown by kinds and classes in the statistical table reproduced herewith. This table is divided according to the number of units of each class, the total horsepower installed and the horsepower actually developed. A comparison of the figures shows that there is still a large field for electrification.—*Electrical News*, Dec. 15, 1922.

EXTENT OF ELECTRIFICATION OF FLOUR MILLS IN CANADA

Kinds of Power Used	No. of Units	Mfrs' Rating, Hp.	Actual Hp.
Boilers	231	17,828	12,706
Engines, steam	227	17,871	14,921
Engines, gas	47	3,134	2,696
Engines, gasoline and oil	181	3,331	3,202
Waterwheels or turbines	1,134	44,106	37,029
Water motors	8	321	295
Electric motors	1,135	50,812	38,220
Other power supplies	4	270	100
Total	2,736	119,845	96,463

Electrical Equipment for Cotton Mills.—G. W. ROBERTSON.—The electrical equipment of Mill No. 8 of the Riverside Division of the Riverside and Dan River Cotton Mills is described. As the equipment of these cotton mills is mostly standard apparatus, the author tells the greater part of the story by means of illustrations.—*General Electric Review*, December, 1922.

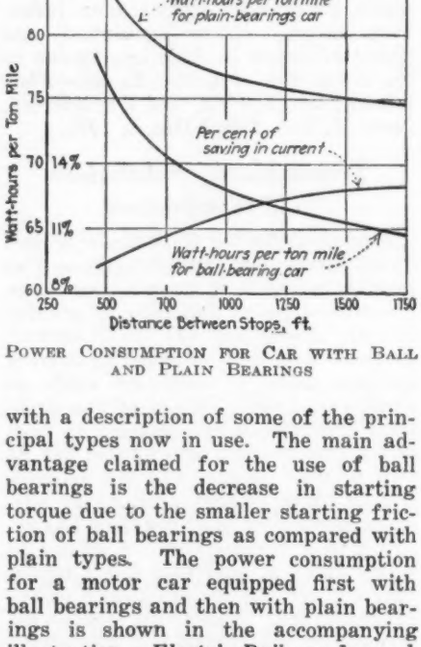
Heat Applications and Material Handling

Electric Arc-Welding Apparatus and Equipment. — J. CALDWELL. — General information regarding the power requirements of welding processes and descriptions of generators and other electrical machines used in welding were given by the author in a paper presented before the Institution of (British) Electrical Engineers on Dec. 14, 1922. In an appendix to the paper a description of an apparatus is given by means of which, for the purpose of experimental investigation, an ordinary electrode may be set to do the work by the use of gears driven by an electric motor. Observations were made of the nature of the deposit through a magnified view on an image screen as well as of the arc. Oscillograms show the alternating current used for the arc to have a curve which is in form a triangular peak with a base of about two-thirds of the duration of each alternation. Claims are made in the paper that flux coated electrodes are essential for alternating-current work and are preferable to bare wires when direct current is used.—*Electrician*, Dec. 22, 1922.

Electric Furnaces for Heat Treatment of Steel.—A. W. LAMONT.—The special features of design and operation of electric furnaces are discussed with particular reference to the furnace installation of the Transcona shop of the Canadian National Railways. The furnace which is used at the Transcona plant is designed to heat 5,000 lb. of locomotive side rods and main rods from room temperature up to a temperature of 1,500 deg. F.—*Engineering Journal* (Canada), January, 1923.

Traction

Anti-Friction Bearings for Electric Cars.—O. R. WIKANDER.—A review is made of the results obtained from the use of anti-friction bearings in the United States and abroad, together with a description of some of the principal types now in use. The main advantage claimed for the use of ball bearings is the decrease in starting torque due to the smaller starting friction of ball bearings as compared with plain types. The power consumption for a motor car equipped first with ball bearings and then with plain bearings is shown in the accompanying illustration.—*Electric Railway Journal*, Dec. 16, 1922.



POWER CONSUMPTION FOR CAR WITH BALL AND PLAIN BEARINGS

Electrophysics, Electrochemistry and Batteries

Electrical Resistivity and Temperature Coefficient of Manganin.—SKEZUG KIMURA and KIKUJI SAKAMAKI. — The resistivity and temperature coefficient of copper manganese alloys and the effects of other elements are investigated. From their experimental results the authors have found that a straight copper-manganese alloy can furnish the best manganin and that there is no need of adding other elements for the purpose of improving its resistivity and temperature coefficient. The straight copper-manganese alloys of about 13 per cent manganese made in the authors' laboratory have a specific resistance of 45 microhms and a temperature coefficient at 22.5 deg. C. of 0.00000348. — *Researches of the Electrotechnical Laboratory, Tokyo, Japan.*

Dry-Cell Specifications.—The Bureau of Standards has issued specifications for the standard sizes of dry cells and flashlight batteries. These specifications are a revision of similar specifications prepared several years ago and published in the first edition of Circular No. 79, on the electrical characteristics and testing of dry cells. A limited number of copies of the new specifications are available for distribution prior to publication of the second edition of the dry-cell circular.—*Technical News Bulletin No. 68 of the Bureau of Standards.*

Telegraphy, Telephony, Radio and Signals

Use of Telephones in Moving Trains. —B. ROSENBAUM.—The article describes a method of communication from a stationary telephone to a subscriber traveling on a train which was tried on a 275-km. stretch of track between Berlin and Hamburg. All previously tried methods required either a very large amount of energy in the sending station or else a high antenna somewhere upon the train. The former was too costly; the latter was impossible owing to the limited overhead room in cuts and tunnels. The tests described were made by the use of high-frequency currents with wave lengths of between 3,000 m. and 4,000 m. emitted from a station near the main line and carried in a wire along the tracks. The author goes into full details as to the best arrangement of the high-frequency current-carrying wire which carries the speech to the train. It is claimed that energies of only 5 watts to 50 watts were required to establish perfect speech transmission.—*Jahrbuch der Drahtlosen Telegrafie und Telephonie*, November, 1922.

Theory of the Telephone Receiver.—L. C. POCOCK.—Some of the simpler electromechanical properties of the telephone receiver that can be derived from the well-known receiver equations first formulated by Poincaré and the experimental researches of Kennelly and his collaborators are described. The equations of a telephone receiver in a generalized form, taking cognizance of some second-order effects, have been given more recently by Wegel and are reviewed in this article.—*Electrician*, Dec. 22, 1922.

Comparison of Condensers at Radio Frequencies.—This pamphlet describes the method of comparison of the capacity and effective resistance or phase difference of two condensers one of which has already been standardized. The method used is that of comparison by substitution; that is, tested and untested condensers are compared by inserting them in turn in a circuit which is brought to resonance with a source of undamped waves.—*Letter Circular No. 77 of the Bureau of Standards.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

City Vs. Power Company

Louisville and Byllesby Interests Fight Before Federal Commission for Falls of Ohio

JUDGING from the arguments presented at a hearing before the Federal Power Commission and by the apparent attitude of Secretary Weeks, its chairman, the probabilities favor an ultimate decision for the Louisville Hydro-Electric Company in the conflict which has arisen with the city of Louisville for power rights at the Falls of the Ohio. The Louisville Hydro-Electric Company is a subsidiary of the Louisville Gas & Electric Company—a Byllesby interest.

The arguments for the Louisville Hydro-Electric Company hinged on the fact that it already has a development of 60,000 hp. provided by an existing steam plant and has in construction a new unit which will furnish an additional 30,000 hp. of steam power. With this installation it is in a position to make excellent use of the variable power which will be developed at the government dam. Moreover, it was pointed out that the company has a complete distributing system serving not only Louisville but the entire surrounding region, power lines radiating as far as 60 miles from the city.

Louisville's Broad Project

The city was represented by former Governor Thatcher and by Gen. William L. Seibert, the constructor of the Gatun Dam. In their arguments it was brought out that Louisville proposes to develop this power through its water company, a private corporation all of whose stock is owned by the city. It is the desire of the city's company to supply power to the entire tributary region, including that which lies adjacent to Louisville in Indiana. Letters from the Mayors of Jeffersonville and New Albany were presented to show that Indiana authorities would not oppose such a plan. It is the ambition of the city to secure a supply of cheap power with which to attract industries, and its plan is to develop 75,000 hp. to 100,000 hp. by developing steam auxiliaries or erecting an auxiliary power plant on either the Green or the Cumberland River. The point was made that the city is anxious not to interfere with the existing business of the Louisville Gas & Electric Company.

Col. William Kelly, the chief engineer of the Federal Power Commission, pointed out that the maximum demand in Louisville and in the cities of Jeffersonville and New Albany during 1920 was 61,000 kw. and that the average load was 25,000 kw. For that reason he is inclined to regard it as questionable whether Louisville could market 100,000 hp. in addition to the 90,000 hp. furnished by the Louisville Gas & Electric Company.

Potomac Company's Rates Before Supreme Court

Arguments were heard before the United States Supreme Court on Wednesday of this week in the appeal of the Public Utilities Commission of the District of Columbia from the decision of a lower court setting aside the valuation placed by the commission upon the properties of the Potomac Electric Power Company as the basis for rates. This case is being followed with particular interest by consumers of electricity within the District of Columbia and by stockholders of the corporation not only because the rate for energy is involved but because of the impounding of the difference between the rates sought by the commission and those charged by the corporation. This difference amounted to approximately $3,200,000 on Jan. 1, and the sum will be distributed among the consumers or among the stockholders according to the decision of the Supreme Court.

The main point of dissension is reproduction value. The company also alleges that the commission made improper deductions for depreciation, it being alleged that, because of constant replacements, no actual depreciation existed. The company further asserts that the commission improperly excluded three properties owned by the company. These three properties are valued by the company at more than $1,000,000.

When the commission began valuation of the properties of the Potomac company, in 1915, it took reproduction values as of July 1, 1914. In deciding the case in May, 1917, it added the actual cost of replacements made from July 1, 1914 to July 1, 1916. The commission declared the value to be $11,231,170 and ordered a 20 per cent reduction in electric rates.

The company contended that reproduction values should have been taken as of July 1, 1916, the year in which actual hearings in the case began. It asserted that the enhanced value of its structural property between July 1, 1914, and July 1, 1916, was $2,521,000 on account of rising costs due to the war. The president of the corporation contended that the value as of July 1, 1916, should have been $15,642,431.

Deschutes Power Case Up

Federal Commission Thought Likely to Decide the Contest in Favor of Columbia Valley Company

AFTER an exhaustive hearing granted to representatives of the Bend Water, Light & Power Company of Bend, Ore., and of the Columbia Valley Power Company, it seems probable that the Federal Power Commission will reject the proposition of the Bend company and will execute the preliminary permit requested by the Columbia Valley Power Company.

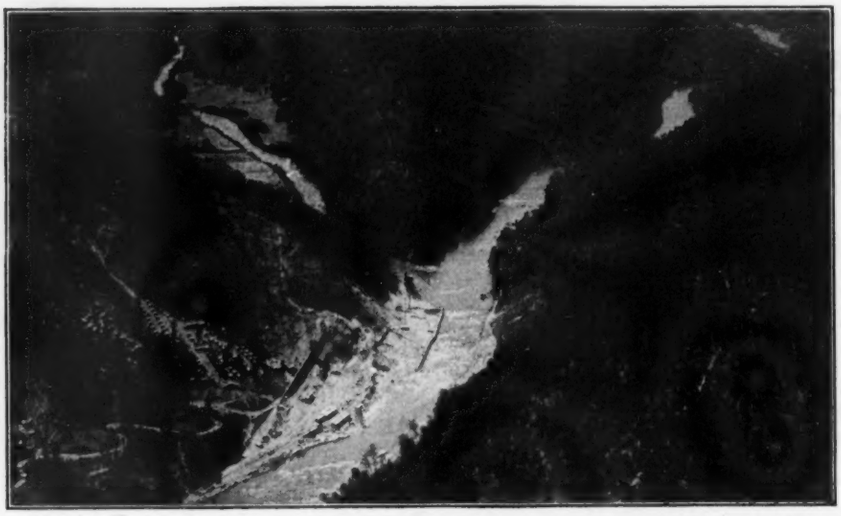
The Columbia Valley Power Company, which is financed by Iowa, Philadelphia and New York interests, was an early applicant for a preliminary permit for the Metolius site on the Deschutes River. The preliminary permit was authorized by the commission on Oct. 10, 1922, but its execution was withheld when the Bend company, backed by an unusual volume of local sentiment, filed a belated application.

At the hearing the Columbia Valley company's representatives stated that they would make no argument as they are entirely willing that the question be settled on its merits. The Bend company devoted practically all of its two hours to an attack on the conclusions of the engineers of the Federal Power Commission. These engineers hold that the Bend project is of doubtful economic feasibility. The reflection on the commission's engineers became so pointed that Secretary Weeks declared he would tolerate no further aspersions on their motives or fairmindedness.

An Unparalleled Pumping Scheme

The proposition is to irrigate 83,000 acres of land in central Oregon by pumping water an average lift of 771 ft. It is admitted that the project is without parallel in the development of irrigation farming in the United States. Engineers of the Reclamation Service joined with those of the power commission in declaring the project not feasible. It was contended that experience in Idaho, where conditions are similar, has shown that land cannot be irrigated profitably where it is necessary to lift the water more than 100 ft.

Col. William Kelly, the chief engineer of the Federal Power Commission, estimated that, making every possible allowance for the cheap power which the Deschutes will furnish, it would be impossible to bring power costs below $3 a horsepower-year. The engineers of the Bend company have arrived at a much lower figure and before a decision is made they will try to justify it.



MATHIS AND BURTON LAKES, WHICH TOGETHER STORE 6,649,000,000 CU.FT. OF WATER FOR TALLULAH RIVER DEVELOPMENTS

Georgia Company's Expansion Program

More than $6,500,000 to Be Expended on the Mathis Development, on the Completion of the Tugaloo Plant, for Transmission Lines and in the Atlanta Zone

EXTENSIVE additions to and improvements of the Georgia Railway & Power Company's systems have been started which will constitute the largest program ever undertaken by the company in a single year, more than $6,500,000 being appropriated for the work. The plans provide for new power plants, substations and transmission lines in various parts of the state, in addition to improved gas and street-railway service in Atlanta. The chief additions which will be made to the electric service facilities are indicated on the accompanying map. More than $1,350,000 will be spent during 1923 for transmission lines outside the 7-mile zone centered at Atlanta, $1,000,000 for the Mathis hydro-electric development, and about $700,000 to complete the Tugaloo development, which was started in 1917 but suspended during the war. The remainder of the $6,500,000 will be spent inside the Atlanta 7-mile zone. It is expected that the Mathis development will be completed by the fall of 1924 and the Tugaloo development in the fall of this year.

The Mathis-Tallulah development will involve a 1-mile tunnel from Lakemont dam, which will feed water into the power house under a 190-ft. head and develop 12,000 kw., or 63,000,000 kw.-hr. annually. This station, which will be several miles from the existing Tallulah Falls plant, will be remotely controlled from there. Water from the Mathis station will then pass through the Tallulah Falls plant and join the flow from the Chattooga River to feed the Tugaloo plant.

The Tugaloo development, which will have a generating capacity of 50,000 kw. at 152-ft. head, will provide more than twice the annual output of Mathis, or 129,790,000 kw.-hr.

A modernization of the Morgan Falls, or Bull Sluice, station will also be completed this year, increasing the capacity 35 per cent. This work is already well under way.

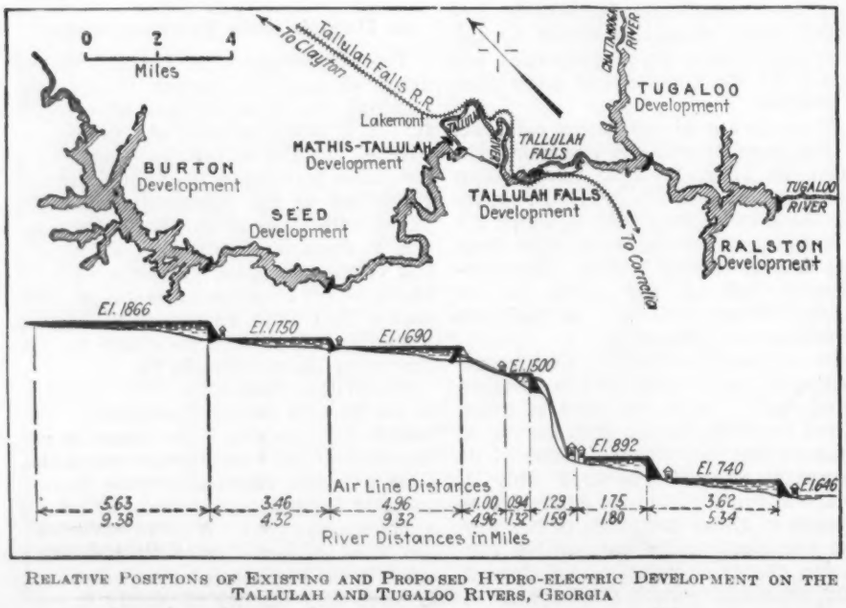
Already leading from Tallulah to Atlanta is a double-circuit, 100,000-volt transmission line. An additional line of the same voltage will be completed to Atlanta by way of Toccoa, Commerce, Winder and Norcross, where step-down substations will be installed. This line will not only improve the reliability of service to Atlanta but also that to the east and southeast of the line. Power from Tugaloo, Mathis and Tallulah will be controlled at a switching station at Tallulah.

Next year a 110,000-volt line will be built from Lindale substation, which will be increased in capacity from 3,000 kw. to 10,000 kw., through Summerville, Lafayette and Chickamauga to Chattanooga, where it will connect with the Tennessee Power Company's system. At the same time a 38,000-volt line will be run from Marietta to Tate.

Inside Atlanta this year a 19,000-volt loop will be completed to increase the reliability and quality of service. In addition to this, extensive improvements will be made in the city's substations, and the Butler and Davis Street steam plants will be enlarged.

All of the foregoing improvements will be made with the next five or ten years' load growth in mind. The present total developed water power on the Georgia Railway & Power Company's system is 150,600 hp. Upon completion of the Tugaloo plant it will be 234,000 hp. In addition to this, however, the entire generating capacity will be backed by six other power companies in Alabama, Tennessee, Georgia and North and South Carolina. The interconnected companies have a total rated capacity of 1,010,355 hp. and are on three separate and distinct watersheds. From extreme tip to tip of the interconnected systems is 900 miles. Notwithstanding this great distance, they have all exchanged energy in emergencies during the past three years very successfully and advantageously.

The need of the development work undertaken by the Georgia Railway & Power Company is indicated by the fact that 46,000,000 kw.-hr. additional consumption may be expected on the company's system by the end of 1923 owing to the natural growth of existing loads and to new business which may be obtained exclusive of the increase in consumption resulting from growth of street-railway and interurban business. The foregoing consumption will represent an increase of 17 to 18 per cent over the corresponding amount for 1922.



RELATIVE POSITIONS OF EXISTING AND PROPOSED HYDRO-ELECTRIC DEVELOPMENT ON THE TALLULAH AND TUGALOO RIVERS, GEORGIA

HOW INTERCONNECTION HAS HELPED

Some indication of the mutual benefits received from the superpower system, of which the Georgia Railway & Power Company is a part is afforded by last year's record of exchange of energy

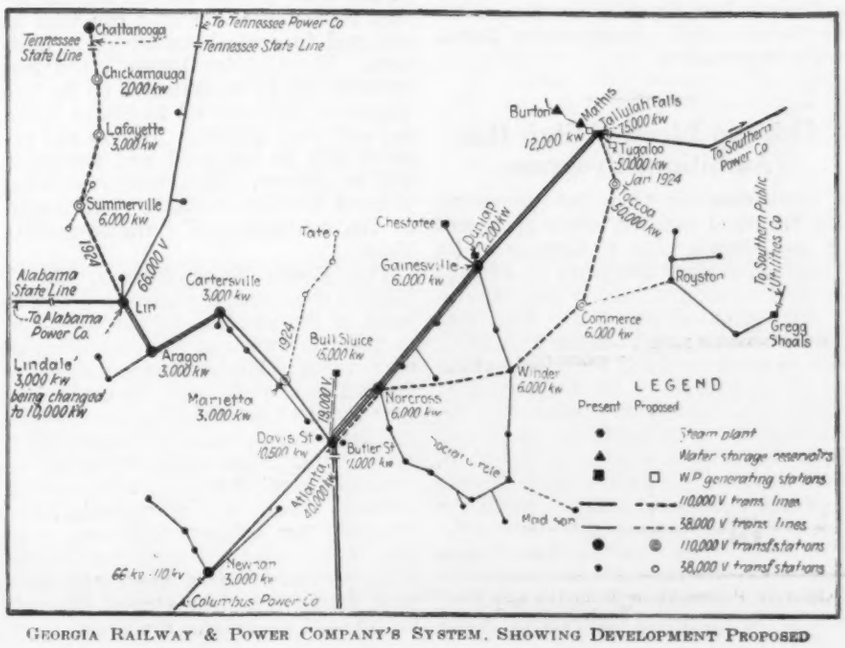
between this system and the six systems with which it is interconnected. The amount of energy received from and delivered to the connected systems was approximately as follows: Tennessee Power Company, 15,000,000 kw.-hr. and zero respectively; Alabama Power Company, 18,000,000 kw.-hr. and 1,500,000 kw.-hr.; Columbus Power Company, 5,000,000 kw.-hr. and 3,250,000 kw.-hr.; Central of Georgia Power Company, 6,000,000 kw.-hr. and 6,000,000 kw.-hr.; Southern Public Utilities Company, 1,500,000 kw.-hr. and zero; Southern Power Company, zero and 27,000,000 kw.-hr. Most of the energy purchased by the Georgia Railway & Power Company was received during October, November, December and January, the dry season. It should be observed that the foregoing receipts and deliveries of energy merely indicate the system from or to which energy was delivered and do not necessarily indicate its ultimate destination. Many times the energy was relayed to some other system. In general, the Georgia Railway & Power Company requires the delivering company to deliver 5 per cent more energy than is to be relayed to the distant company to compensate for line losses. In some cases standing contracts are held for receiving or delivering a definite amount of energy each year, but in general the exchange of energy is only for emergency purposes. By agreement of the interconnected companies, the system operator of the Georgia Railway & Power Company has supervision over the interchange of energy and the operating methods involved in making the interchange. The chief problem is to maintain the proper frequency and voltage to facilitate interchange and division of the wattless current as well as voltage regulation. The contracts, in general, cover only the amount which shall be paid for the energy, there being a fairly uniform

SITE OF 50,000-KW. TUGALOO DEVELOPMENT, WHICH UTILIZES COMBINED FLOW FROM TALLULAH AND CHATTOOGA RIVERS

This dam and power house which will be completed before Jan. 1, 1924, will add approximately 50 per cent to the company's waterpower output. The dam will be 140 ft. high and will form a lake covering 557 acres.

WATER POWERS ON THE TALLULAH AND TUGALOO RIVERS

Burton Development:	
Height of dam, ft.	116
Drainage area above dam, sq.miles	136
Area of reservoir, acres	2,775
Capacity of reservoir, cu.ft.	5,280,000,000
Capacity of reservoir in equivalent kilowatt-hours:	
At Seed power house	5,540,000
At Mathis-Tallulah power house	17,300,000
At Tallulah Falls power house	55,000,000
At Tugaloo power house	13,850,000
At Ralston power house	8,600,000
Total capacity of reservoir	100,290,000
Generating capacity, kw.	6,000
Head, ft.	84-116
Average annual output, kw.-hr.	32,200,000
Seed Development:	
Height of dam, ft.	60
Drainage area above dam, sq.miles	144
Area of reservoir, acres	560
Available capacity of reservoir, cu.ft.	350,000,000
Generating capacity, kw.	5,000
Head, ft.	60
Average annual output, kw.-hr.	20,000,000
Mathis-Tallulah Development:	
Height of dam, ft.	90
Drainage area above dam, sq.miles	153
Area of reservoir, acres	834
Capacity of reservoir, cu.ft.	1,369,000,000
Capacity of reservoir in equivalent kilowatt-hours:	
At Mathis-Tallulah power house	2,210,000
At Tallulah Falls power house	15,000,000
At Tugaloo power house	3,940,000
At Ralston power house	2,450,000
Total capacity of reservoir	23,600,000
Generating capacity, kw.	12,000
Head, ft.	190
Average annual output, kw.-hr.	63,800,000
Tallulah Falls Development:	
Height of dam, ft.	116
Drainage area above dam, sq.miles	190
Area of reservoir, acres	63
Available capacity of reservoir, cu.ft.	63,000,000
Generating capacity, kw.	72,000
Head, ft.	608
Average annual output, kw.-hr.	200,000,000
Tugaloo Development:	
Height of dam, ft.	140
Drainage area above dam, sq.miles	481
Area of reservoir, acres	557
Available capacity of reservoir, cu.ft.	725,000,000
Generating capacity, kw.	50,000
Head, ft.	152
Average annual output, kw.-hr.	129,790,000
Ralston Development:	
Height of dam, ft.	90
Drainage area above dam, sq.miles	540
Area of reservoir, acres	1,040
Available capacity of reservoir, cu.ft.	900,000,000
Generating capacity, kw.	30,000
Head, ft.	94
Average annual output, kw.-hr.	88,850,000
SUMMARY	
Total storage capacity, cu.ft.	8,687,000,000
Total head, ft.	1,220
Total generating capacity, kw.	175,000
Total average annual output, kw.-hr.	534,640,000
Average annual rainfall over entire watershed, in.	65
Average annual run-off, in.	40



GEORGIA RAILWAY & POWER COMPANY'S SYSTEM, SHOWING DEVELOPMENT PROPOSED

rate for hydro-electric energy but a sliding rate for steam power depending on the price of coal.

Except where standing contracts exist for a fixed amount of energy each year, no company is compelled to deliver or accept any energy. If one company desires energy, it endeavors to see who will furnish it and no company is compelled to give it unless it has surplus power available.

This development is in charge of Charles G. Adsit, vice-president and executive engineer of the Georgia Railway & Power Company. A special construction force of about 1,500 men will be employed.

International Paper Company Has New 25,000-Kw. Plant

Water will, it is announced, be turned into the International Paper Company's new storage basin at Sherman Island, N. Y., within a few weeks, and the plant is expected to be in operation about June 1 with an installed capacity of 25,000 kw. Contracts are already in hand whereby industries and consumers in the surrounding territory will purchase the full output.

This plant is on the Hudson River within a few miles of the company's Glens Falls mill. The International has three other plants in the vicinity, but none of the power generated will be consumed by these mills.

Tax-Free Bonds Disapproved by Lower House

The resolution to submit to the states an amendment to the United States Constitution to prevent the exemption of securities from taxation was adopted by the House of Representatives this week by a vote of 293 to 101. The resolution thus commanded five more than the two-thirds vote required to pass a constitutional amendment resolution.

Twenty-four Republicans opposed the resolution, while twenty-three Democrats supported it.

Chicago Electric Club Has Ambitious Program

Three concrete plans for promoting the electrical industry were sponsored by the Electric Club of Chicago at its "inspiration day" luncheon on Jan. 23 as part of a progressive program to be carried out during 1923. President Paul W. Koch said that the first thing was to start sectional technical groups among club members for the purpose of studying one particular subject. The second was to "tie in" with the "more and better business" campaign of the N. E. L. A. by starting a bureau to lay definite plans for developing each section of the industry from the central station to the contractor. The "electric home" idea was the third plan, and it was forcefully championed by Walter Collins, secretary of the Electrical Contractors' Association of Chicago, who declared that the Cleveland Electric Club had been instrumental in causing sixty-five "electric homes" to be built in 1922.

Commercial Side of N. E. L. A. Promoted at Denver

Seventy-five leading central-station commercial executives from all parts of the country, East as well as West, met at Denver this week for the midwinter session of the N. E. L. A. Commercial Section committees. The purpose of holding the meetings so far west was to encourage a large attendance of central-station commercial men from that part of the country and make them feel that Eastern men are interested in their problems.

Discussing plans for the New York convention in June, Oliver R. Hogue, chairman of the Commercial Section, said: "The electrical industry is now getting into its commercial stride, and the national convention of 1923 will be of the greatest commercial significance in the history of the central-station business. Much important information on selling methods will be presented at the convention and many surprises are in store in the presentation of this material. Not only will every central-station executive want to be present himself, but he should see that his commercial manager and the principal members of his selling staff are also on hand for the important general and commercial sessions. The 1923 meeting is going to be a shirtsleeve convention, by which I mean that the commercial men are going to take off their coats and go after the business."

G. Bertram Regar, chairman of the Lighting Sales Bureau, pointed out some of the commercial possibilities in the field of lighting sales. It is possible, for example, he said, with benefit to the customer in general, to double the intensity of existing lighting installations, and since lighting makes up 58 per cent of the total central-station income today, tremendous increases can thus be achieved in central-station gross business. The Lighting Bureau's program for 1923 will be concentrated on the two important subjects of residence lighting and store lighting. Papers and reports will be prepared and circulated well in advance. Novel means are being planned for the dramatic visualization at the convention of business-getting ideas.

The Power Sales Bureau, C. K. Nichols chairman, expressed a desire to learn of the problems of the West and to make the work of the committee of more value to Western commercial men. Particular attention will be devoted to new types of drives and control which will increase production and lower operating costs. Plans for carrying on the industrial heating school will be carried forward. Western men emphasized the necessity for holding such courses in the West. The Power Sales Bureau fully appreciates this need, and next year the work will be started through the various geographic divisions.

Joint Committee for Business Hard at Work

At a meeting of the executive committee of the Joint Committee for Business Development held in New York on Jan. 9, P. R. Labelle, power sales manager of the Shawinigan Water & Power Company, Montreal, was elected a member of the executive committee, and J. S. Tritle, merchandising manager of the Westinghouse Electric & Manufacturing Company, was included in the membership of the general committee. Director Lane announced that the committee now had 749 correspondents.

It was decided to make a list of available electrical publications prepared by the national associations co-operating with the committee and distribute it to the trade. C. E. Greenwood, chairman of the appliance department, announced that he was preparing a booklet on vacuum cleaners and another on commercial cooking; P. B. Zimmerman, chairman of the lighting department, is at work on a domestic lighting prospectus, and A. K. Baylor, chairman of the wiring department, reported progress.

A newly created electrical transportation department has Charles R. Skinner, Jr., of the New York Edison Company, as chairman. The electrification of textile mills is to be taken up by the electric power department, of which H. H. Holding is chairman. C. K. Nichols, chairman of the department of electric heating and melting, reported that he had gathered material for a series of booklets.

The original plans for the joint committee prize contest have been somewhat changed, and the committee will announce on Feb. 10 the rules governing the award of a cup to the electrical club, league, local association or local company which reports the most effective and interesting local activity. Five other prizes in the form of plaques will be awarded for meritorious local activities.

A motion was passed to consolidate the advertising committee of the joint committee and the publicity advertising council of the Society for Electrical Development into one body. It was decided that the first publication to be sent out to the committee's correspondents would be one on store and show-window lighting.

Fitkin Properties Report Year of Records

Representatives of the properties operated by the General Engineering & Management Corporation of New York, known as the "Fitkin group," held their annual convention last week at the offices of A. E. Fitkin & Company. They consisted of the local operating heads of the Tidewater Power Company, Commonwealth Light & Power Company, Interstate Electric Corporation and the Morris & Somerset Electric Company and their subsidiaries, numbering twenty-six electric light and power, gas, water, ice and street-railway companies serving more than a hundred communi-

ties in New Jersey, Pennsylvania, North Carolina, Florida, Texas, Missouri, Kansas and Michigan. This organization has just completed the most successful year in its history as owner and operator of public utilities. As of Nov. 30 last, the number of customers served by these combined properties in the twelve months previous increased by development and acquisition of new properties from 29,151 to 48,961 and the capacity of their central stations from 8,315 kva. to 40,595 kva.

Meetings were held throughout the week and the keynote was distinctly optimistic. Plans for commercial expansion and development were the chief consideration. In addition to the organization program, the convention was addressed by F. W. Smith, president National Electric Light Association; M. R. Bump of Henry L. Doherty & Company, A. K. Baylor of the General Electric Company and Earl E. Whitehorne, commercial editor ELECTRICAL WORLD.

Carolina-Tennessee Company Wins—Appeal Taken

The Carolina-Tennessee Power Company won a victory in the hearing at Murphy, N. C., of its suit against the Hiawassee Power Company over the right to power sites, referred to in the ELECTRICAL WORLD for Jan. 20, page 176, before Judge P. A. McElroy. The Hiawassee company will, however, as predicted, appeal to the State Supreme Court. Officials of the Carolina-Tennessee company are confident that the Legislature will not repeal its charter.

Indiana Legislature Acting on Commission Bills

One of three measures affecting the administration of the Indiana Public Service Commission which were introduced in the State Legislature has been killed in the Senate, another is coming up as a special order of business, and the third, a House bill, is still in committee.

The bill killed provided that utility bond issues should not exceed the taxable valuation of the company. It was reported for indefinite postponement by the committee on finance, and the report was adopted by a viva voce vote. The bill before the Senate would require the taxable valuation of a utility to be the basis on which rates are made. This bill came out of committee with a divided report, a majority favoring indefinite postponement. It is possible that a public hearing may be held on the measure. The House bill would authorize the holding of a referendum to decide whether a municipally owned public utility shall be exempt from operating under the Public Service Commission. A majority of the committee is expected to favor it.

Code Changes Discussed by Electrical Inspectors

In the first two days of the eighteenth annual meeting of the Western Association of Electrical Inspectors at Chicago this week twenty-three proposed changes of the National Electrical Code were considered in view of the revision to be made this year. These changes, contained in the report of the electrical committee of the National Fire Protection Association, were explained by Chairman Dana Pierce, as being the outcome of three years of investigation into troubles reported by and protests made by electrical inspectors. Unless further protests are made the new changes will go into effect after a public hearing at New York on March 12.

Among the most prominent changes are those which require color identification of fuses. Fuses for 600 volts will still remain red, 250-volt cartridge fuses of 15 amp. capacity and less are to be yellow or orange, and fuses over 15 amp. are to be green. To aid in distinguishing plug fuses, those of 15 amp. and under are to have a hexagonal opening in the brass cap through which a mica window will appear. To insure rigidity flush-switch and receptacle metal plates are to have a thickness of 0.04 in.

C. A. Bates, reporting on the 600-watt sockets, declared that some manufacturers were now in a position to furnish this class of equipment.The new rules require their use wherever flexible cords are used.

George Ainsworth, New York, opened the Wednesday discussion by favoring the adoption in new buildings of outlet boxes having a depth of at least ½ in. for all side-wall outlets. By such a uniform regulation designers could be certain that their fixtures would be properly installed.

A 3-in. minimum diameter for side-wall outlet boxes flush with the plaster was favored by Edwin L. Kopp, Louisville. Such construction would be in line with the development trend of fixtures and would aid in competing with foreign fixtures which, while artistic, do not pass inspection tests.

Regarding motor protection, A. R. Small, Chicago, felt that the new Rule 8C should be reworded. Too much leeway by special permission should not be given, he thought, since it would only confuse inspectors.

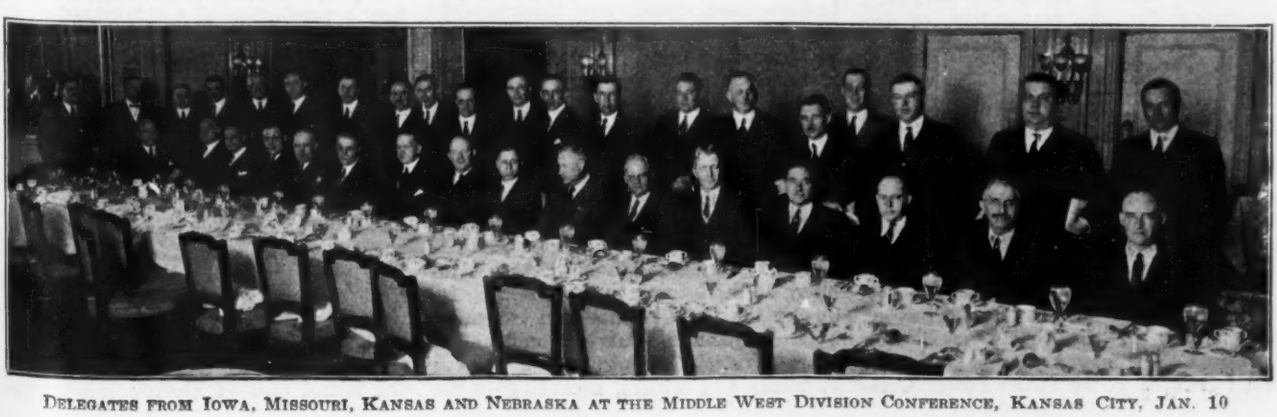
The question of proper wiring for cold-storage plants was raised by R. E. Moran, Memphis, who said that his experience with conduit had forced him to go back to weatherproof wiring and porcelain insulators. J. C. Forsyth, New York, gave his experience on this class of wiring. By paying proper attention to joints and repainting them twice a year, he had had little trouble.

Although no report on 2,500-volt motors was presented, W. J. Canada, New York, voiced the opinion that when properly installed the fire risk was no greater than with motors operating at lower voltages. With the increasing growth of industrial voltages he urged that attention be given to this class of equipment.

Another Utility Information Bureau Started

The Louisiana and Mississippi Public Service Information Bureau was organized Jan. 19 at the New Orleans meeting of the committees of the Southwestern Geographic Division of the National Electric Light Association. W. J. Aicklen, Jr., general manager of the Consumers' Light & Power Company of New Orleans, was elected chairman of the committee to organize the bureau. Its work will include distinctive bulletins and news services for the two states, according to the plans adopted. H. C. Abell, chairman of the committee on organization of state information bureaus, and M. H. Aylesworth, executive manager N. E. L. A., were at the meeting and aided in the organization.

The completion of this plan means that there will be a public service information bureau for every state in the Southwestern Geographic Division. This is one of the objectives that President E. H. Kifer of the division had set for his administration.



DELEGATES FROM IOWA, MISSOURI, KANSAS AND NEBRASKA AT THE MIDDLE WEST DIVISION CONFERENCE, KANSAS CITY, JAN. 10

Power Versus Irrigation

Flathead Lake Project, Now Before Power Commission, Involves Important Principle

ACTIVE consideration of the Flathead Lake power project is being begun by the Federal Power Commission. The development of the 275,000 hp. which can be harnessed at that point has a bearing on the development of the Columbia Basin project of the State of Washington, and officials of that state are urging that no power rights be given unless the interests of irrigation have priority. The Federal Power Commission probably will be influenced in this case by the relatively greater importance of the power possibilities of the project, and there is reason to think that the commission will not be inclined to accept all of the conditions which the Washington State officials would impose.

The Rocky Mountain Power Company, which is a subsidiary of the Montana Power Company and of the Anaconda Copper Mining Company, was one of the first to apply for a preliminary permit following the passage of the water-power act. The commission, having in mind that a conflict would take place between those who would develop the power and those interested in irrigation on the Upper Columbia, appointed a board to report on the project. This board found that Priest Lake and Pend d'Oreille Lake have all the storage capacity necessary for the Columbia Basin project provided that the natural flow from Flathead Lake is not interfered with during the critical months of the irrigation season. For that reason the board recommended that Flathead Lake be reserved for power users and the two lower lakes for irrigation storage.

POWER VERSUS IRRIGATION

The case is of unusual interest not alone because of the large amount of power involved but because of the principle concerned in deciding just how far water for agricultural purposes may take precedence over that to be used for power purposes. In this instance the logical development of Flathead Lake for power purposes would affect adversely a small portion of the territory which it is planned to irrigate. It is typical of numerous cases where the logical development is to use the upper storage for power purposes, providing for the restoration of the water lower down after it has served the former end.

Federal Power Commission Proceedings

A license covering two small projects on the San Gorgonia River in California has been granted by the Federal Power Commission to the San Gorgonia Power Company. The company has a long-term lease to sell the output of the plants to the Southern Sierras Power Company. A license also has been granted to the Idaho Power Company for a transmission line from Caldwell, Idaho, to Ontario, Ore. The requirement in the license of the Snow Mountain Power Company of San Francisco that additional machinery be installed in its power house before Dec. 31, 1922, was extended for one year. The project may be sold to the municipalities adjacent to San Francisco Bay.

Preliminary permits were granted to the Eureka (Mont.) Hydro-Electric Company, covering a small project on Graves Creek in the Blackfeet National Forest; to Thebo, Starr & Anderton, Inc., covering two projects on the McCloud River, in the Shasta National Forest, and a project on the American River near Placerville involving 25,000 hp.; to the Clarion River Power Company for two dams in connection with its licensed project near Foxburg, Pa.; to the Alabama Interstate Power Company, a subsidiary of the Alabama Power Company, covering a comprehensive development on the Tallapoosa River involving four dams and power houses, and to Anna P. Gray for three small projects on South Colony Creek in Custer County, Col. An extension of one year was granted R. W. Hawley to carry out the conditions of the preliminary permit issued to him on Aug. 24, 1921, for a project on Silver Creek in California.

Helena (Ark.) Gas & Electric Company Sold

Possession of the Helena Gas & Electric Company of Helena, Ark., passed on Jan. 15 to the Arkansas Utilities Company, which now owns and operates electric plants at Clarendon, Cotton Plant, Kingsland, Brinkley, Fordyce and Rison. The Arkansas Utility Company is a subsidiary of the Community Power & Light Company. The Helena property will be consolidated with the other holdings of the company in Arkansas, and J. M. Wharton, who was secretary-treasurer and manager of the Helena utility, is to be general manager of all the plants, with headquarters at Helena.

Danger of New Coal-Mining Strike Thought Past

The conference of bituminous coal operators and union miners of Illinois, Indiana and Ohio has unanimously adopted a basic wage scale agreement to become effective April 1, 1923, and remain operative for one year. This agreement continues the present basic wage scale which became effective after the strike in August, 1922, and was originally drafted in 1920. This action, it is thought, gives definite assurance that there will be no national coal strike in the soft-coal fields for one year.

The fundamental cause of the instability of the bituminous coal-mining industry that has its effects in unreasonably high prices, labor troubles and transportation difficulties is a surplus of mines and miners, according to the preliminary report of the United States Coal Commission sent to President Harding and Congress on Monday of last week.

"There can be no permanent peace in the industry until this underlying cause of instability is removed," says the report of the fact-finding commission established to study the coal industry.

Standards Committee Has 122 Projects Under Way

Speaking recently before the Boston Section of the American Institute of Electrical Engineers, Dr. P. G. Agnew, secretary of the American Engineering Standards Committee, said that 122 projects are being worked upon by the committee at present, that thirty organizations are represented on the committee today and that twenty-eight standards have already been adopted as a result of its work. About a thousand individuals are at work in different organizations upon the problems of duplication, and more than two hundred national bodies are co-operating with the committee in its service. There are now fourteen national standardizing bodies affiliated with the committee. Last year the work of the committee increased more than 50 per cent. The United States, Great Britain and Germany have led the world in standardization brought about by firms engaged in industry.

In a discussion following Dr. Agnew's address Dr. A. E. Kennelly defined standardization as "the selective adoption of instrumentalities used in cooperative work for aiding joint effort and eliminating waste." Prof. D. C. Jackson pointed out that standardization should lead in the long run to the greater development of individual effort.

Natural Gas for Generating Electricity

Utilization of the natural gas of the Amarillo field in Texas for generating electricity on a scale of great magnitude is being considered by large financial interests, according to S. J. Keese, an engineer of Los Angeles, Cal., who has been investigating the available gas supply of the existing wells and the cost of the proposed electric project. It is stated that there is now a production of 1,000,000,000 cu.ft. of gas a day from twenty-seven wells that are scattered over the proved territory of 1,200 square miles in the Panhandle of Texas. Mr. Keese's surveys have had in view the feasibility of using natural gas for generating sufficient electric power to operate the trains of the Atchison, Topeka & Santa Fé between Kansas City and Albuquerque, N. M.

It is thought that the Santa Fé is favorably inclined to the proposition provided the power cost is not too great. While Mr. Keese's figures are not as yet available, it is predicted that the initial cost of electric power pro-

duced with natural gas will not be much in excess of that generated from water power.

The project of laying a pipe line from the natural-gas field to Denver, Col., is still in abeyance. The estimated cost of such a line and the necessary equipment is $16,000,000, which is believed by some engineers to be prohibitive. The wells of the Amarillo field are of enormous production, the largest one gaging 180,000,000 cu.ft. a day, and the underground reservoir of the fuel is thought to have been barely touched.

Texas Bureau's Figures on Natural Gas as Fuel

Compilations made by the Texas Public Service Information Bureau at Dallas, Tex., show that the use of natural gas as fuel in electric power plants has increased steadily throughout the states having this fuel available, according to George McQuaid, in charge of the bureau. Mr. McQuaid's investigations disclose that in September, 1922, the volume of gas consumed in electric power plants exceeded 100,000,000 cu.ft. a day for the first time. The figures for the month showed an average of 103,500,000 cu.ft. daily. Texas was sixth in this list, having used a total of 238,041,000 cu.ft. during the month. California used 624,056,000 cu.ft. and Oklahoma 444,008,000 cu.ft.

Mr. McQuaid goes on to say that only fifteen states have natural gas available for fuel for power plants. Fuel oil is used to some extent by power plants in all the states except ten, while coal is used by them in all states except California, Idaho, Nevada and Utah. Utah alone produces all its electric energy by water power.

Power Company Sues Utilities Commission

The Colorado Power Company, which has made several ineffectual efforts to secure an increase in rates, has brought suit in the United States District Court against the three members of the Colorado Public Utilities Commission. The company asks that the commission be restrained from enforcing the schedule of rates authorized by it in 1920, asserting that the central system of the corporation earned a gross revenue in 1922 of only $682,663, netting $55,156, exclusive of government taxes, and that this is a return on the valuation of only 0.51 per cent.

A 40 per cent increase was sought in 1920 on average rates and 20 per cent on special contract rates. This is again prayed for. If the rates sought had been allowed during 1922, it is claimed, the gross revenue would have been $837,769 and the net revenue $176,251, or 1.60 per cent on the valuation.

The "central system" comprises the Shoshone development, the Boulder development, the Georgetown development and the Leadville system, all hydro-electric. The company's valuation is $11,000,000. It is set forth that it operates its systems over sections of the state sparsely populated, high mountain ranges and territories unprotected from fierce storms, and that the rates now in effect are unfair, unreasonable and confiscatory.

Underwriters Review Year

More Work Was Accomplished in the Electrical Laboratories in 1922 than Ever Before

THE volume of work in the electrical department of the Underwriters' Laboratories during 1922 exceeded that of any preceding year, according to the official report, recently issued, and necessitated the employment of more engineers and laboratory assistants. The development of a multitude of special appliances for the utilization of electricity in home, office and factory continued steadily and was reflected in the increase of applications to the department for examinations and tests, the engineers having been constantly called upon to devise new test methods to bring out the characteristics and essential features of installations and of devices so new that standards based upon service records are incomplete or wholly lacking.

Vending machines, advertising and display devices, electrical toys, "permanent-wave" hair-dressing appliances, devices for waxing motion-picture films, anchors for screws in walls, surgical and dental appliances and so forth lent variety to the routine work on wires, wiring devices and the more standardized things.

The extraordinary spread of "radio" threw a large amount of work on the department. Grounding switches, lightning arresters and other small fittings were most numerous, but reports were also made on elaborate and expensive outfits for the complete power equipment of amateur or professional transmitting stations.

During the year a standard was developed on a form of rubber-sheathed cord, known as "type SJ" cord, which is for use on portables where the conditions are less severe than for the "type S" cord developed in 1921. In co-operation with the committee on new developments of the National Fire Protection Association's electrical committee, investigations of three new special forms of wiring were made. Of these one was later withdrawn by the submitter, one was passed by the Laboratories and one is still being studied.

Several new automatically regulating electric flatirons have been tested and label service is now in prospect on such irons to distinguish them sharply from irons which lack this protective feature.

In the Laboratories' new quarters in New York there is to be a much larger and better equipped electrical testing station, laid out with special attention to present-day standards of safety and with many more facilities for expeditious work.

Illinois Utility Plans Issues of $20,000,000

The Public Service Company of Northern Illinois has filed an application to the Illinois Commerce Commission for permission to issue $20,000,000 in new bonds and stocks. This increase in capital is to finance a large program of expansion of generating facilities and also to retire some securities falling due in the near future. The application covers the issuance of $5,000,000 of 5½ per cent first lien and refunding bonds, an increase of 100,000 shares in no-par-value common stock and $5,000,000 additional 6 per cent preferred stock. The proceeds of this bond issue will go in part to retire $1,750,000 collateral notes which mature Feb. 1 and in part toward the erection of the new Waukegan generating plant now under construction, which will start operation about Sept. 1, and to increase the capacity of the Joliet generating station by the addition of 30,000 kw. The two projects last named will require about $9,000,000.

Stockholders will be asked at the annual meeting on Feb. 26 to increase the common stock by 100,000 shares of no par value and the preferred stock by $5,000,000. If approval is obtained, the company will later ask permission for the issuance of 52,980 shares of additional no-par-value stock.

Last Year's Work of Joint Fuel Committee

A report on the work done by the Washington office of the joint fuel committee of the National Electric Light Association, the American Gas Association and the American Electric Railway Association has been made by John Price Jackson, the managing director, to John W. Lieb, the chairman of the committee.

The character of the work that has been done for individual utilities is outlined as follows: Giving information as to procedure, government regulations, etc.; obtaining priorities where needed, increasing car supply, accelerating car movements, preventing confiscation of cars, relieving stress caused by embargoes, endeavoring to prevent the necessity for paying excessive prices, advising as to where coal of the right quality is purchasable, aiding the shipment of plant supplies, providing cars for coke and carrying on other work which develops in particular instances.

At the close of the year, the report says, the emergency situation had largely relaxed and the government methods were reasonably well established. Emergency cases of specific utilities requiring aid had declined greatly in number.

The fuel situation in the country, however, is still upon an unsettled basis, and should a long period of genuine blizzard weather occur many utilities would again be thrown into the emergency class.

New Code of Ethics

Committee of Four Major Engineering Bodies and Heating Society Formulates Principles

A NEW code of ethics drawn up by a joint committee of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society of Heating and Ventilating Engineers, under the chairmanship of Prof. A. C. Christie of Johns Hopkins University, has been made public. Its text follows:

"Engineering work has become an increasingly important factor in the progress of civilization and in the welfare of the community. The engineering profession is held responsible for the planning, construction and operation of such work and is entitled to the position and authority which will enable it to discharge this responsibility and to render effective service to humanity.

"That the dignity of their chosen profession may be maintained, it is the duty of all engineers to conduct themselves according to the principles of the following code of ethics:

"1. The engineer will carry on his professional work in a spirit of fairness to employees and contractors, fidelity to clients and employers, loyalty to his country and devotion to high ideals of courtesy and personal honor.

"2. He will refrain from associating himself with or allowing the use of his name by an enterprise of questionable character.

"3. He will advertise only in a dignified manner, being careful to avoid misleading statements.

"4. He will regard as confidential any information obtained by him as to the business affairs and technical methods or processes of a client or employer.

"5. He will inform a client or employer of any business connections, interests or affiliations which might influence his judgment or impair the disinterested quality of his services.

"6. He will refrain from using any improper or questionable methods of soliciting professional work and will decline to pay or to accept commissions for securing such work.

"7. He will accept compensation, financial or otherwise, for a particular service from one source only, except with the full knowledge and consent of all interested parties.

"8. He will not use unfair means to win professional advancement or to injure the chances of another engineer to secure and hold employment.

"9. He will co-operate in upbuilding the engineering profession by exchanging general information and experience with his fellow engineers and students of engineering and also by contributing to work of engineering societies, schools of applied science and the technical press.

"10. He will interest himself in the public welfare in behalf of which he will be ready to apply his special knowledge, skill and training for the use and benefit of mankind."

The representatives of the A. I. E. E. on the joint committee were Prof. Comfort A. Adams, Giuseppi Faccioli, George F. Sever and L. B. Stillwell. The code has already been adopted by the A. S. M. E.

Brief News Notes

American Power & Light Acquires Minnesota Utilities.—The stock of the Minnesota Utilities Company, an electric light and power concern owned by Wausau (Wis.) investors and supplying a number of small cities in Minnesota, has been purchased by the American Power & Light Company of New York.

Alabama Legislature Backs Ford.—Henry Ford's proposal to lease and purchase government power sites and property at Muscle Shoals has been indorsed in a joint resolution of the Alabama Legislature. A committee will be named by the Senate and House to draft "suitable resolutions" to forward to Congress through Alabama Representatives and Senators.

Trunk-Line Electrification Project in Ontario.—Sir Henry Thornton, the new president of the Canadian National Railways, announced recently that electrification of the Grand Trunk Railway from Toronto to Niagara Falls via Hamilton and St. Catharines is the only means of providing for the increased traffic. He added that there were no serious obstacles to electrification.

Indiana Commercial Men for Commission.—The result of the referendum vote taken by the Indiana State Chamber of Commerce in the local chambers of the state on the question of retaining or abolishing the Public Service Commission was overwhelmingly for its retention, though many believed there should be changes made in the law.

Oconto and Peshtigo Companies Become Northeastern Power Company.—Two small Wisconsin electric light and power companies, the Oconto Service Company and the Peshtigo Electric Company, have been merged in the Northeastern Power Company, a subsidiary of the Wisconsin Public Service Corporation of Milwaukee, and Charles M. Haffeler will manage the two plants from Oconto. At Peshtigo an attempt to bring about municipal ownership failed signally.

New Indiana Transmission Lines.—Construction work on a 33,000-volt transmission line from Newcastle to Cambridge City, Ind., is now under way. The 13,200-volt line from Cambridge City to Connersville will be changed to 33,000 volts. This includes the installation of 33,000-volt substations at Connersville, Milton, Cambridge City and Newcastle. The construction of a high-tension transmission line from the Norway plant of the Indiana Hydro-Electric Power Company to Logansport has been authorized and construction will start immediately.

Wisconsin Hydro-Electric Company Takes Over Chetek Plant.—On Jan. 4 the Wisconsin Hydro-Electric Company, whose headquarters are at Amery, Wis., not Apple River, as stated in "Brief News Notes" on Dec. 30, took over the Chetek Light & Power Company, and it will supply the customers of the latter from its 25,000-volt line. This line is to be extended in the spring to Sand Creek and Colfax, a distance of about 25 miles, where it will connect with the company's existing line and complete a loop system.

Badger Public Service Company Wins Right to Enter Calumet, Wis.—The Circuit Court at Madison, Wis., has reversed the decision of the State Railroad Commission which granted the Eastern Wisconsin Electric Company permission to extend its lines into the town of Calumet and barred out the Badger Public Service Company. The long-drawn-out contest over the exclusive right to serve Calumet with light and power has now been appealed to the Wisconsin Supreme Court.

Dynamos on the Dead Sea.—Plans for the electrification of Palestine by raising the level of the Sea of Galilee and harnessing the historic River Jordan, involving an initial expenditure of $10,000,000, are described in "Palestine—Its Commercial Resources, with Particular Reference to American Trade," by Addison E. Southard, American Consul at Jerusalem, just published by the Department of Commerce. The scheme calls for the canalization of the Jordan Valley from the Sea of Galilee to the Dead Sea, where, under irrigation, it is expected that copious crops can be produced.

Negotiations of Alabama Power Company for Montgomery Utilities Completed.—With negotiations for the purchase of the Montgomery Light & Water Power Company and the Montgomery Light & Traction Company from Henry L. Doherty & Company completed and the sale ordered by a federal judge, as necessitated by the companies being in the hands of receivers, only the formal approval of the Alabama Power Service Commission is needed to consummate the transfer. The petition will be heard by that body on Feb. 12.

French Government to Assist Rural Electric Service.—A bill adopted by the Council of Ministers in France authorizes 4 per cent loans to communes, agricultural societies and approved syndicates through the National Office of Agricultural Credit for the extension of electric service in certain country districts. The loans will be guaranteed under conditions similar to those under which loans for cheap dwellings are obtainable. The total of the government loans is limited to 600,000,000 francs and an amount equal to the loan must in every case be raised by the community or society applying for it.

Shawinigan Water & Power to Develop St. Maurice River.—The Shawinigan Water & Power Company has formed a subsidiary company under the name of the St. Maurice Power Company, Ltd., to develop Gres Falls and Gabelle Rapids on the St. Maurice River, Quebec. The new company has common-stock capital of $8,000,000 and an authorized bond issue of $12,000,000, of which $10,000,000 is now being issued by a New York syndicate.

Stanley Library Given to Pittsfield Works.—The entire technical library of the late William Stanley, electrical inventor and founder of the Stanley Electric Company of Pittsfield, Mass., which became part of the General Electric Company, has been given by his widow, Mrs. Lila Stanley, for the permanent use of employees of the General Electric Company in Pittsfield. In the library are about a thousand volumes on scientific subjects, including a set covering the researches of the Royal Society of London from 1665 to 1800.

North American Company Buys General Squier's Patent.—The North American Company has, it is reported, purchased the patent rights of the "wired-wireless" system of transmission and receiving radio apparatus invented by Major-General George O. Squier, Chief Signal Officer, U. S. Army, which facilitates the broadcasting of news, entertainment and music over the entire wire systems of power and light companies in connection with regulation sending and receiving sets. It is said that the North American Company will supply a radio service to its power consumers in Cleveland, Milwaukee, St. Louis and other cities where it operates.

Colorado Colleges Learn About the Utilities.—A movement enlisting the cooperation of colleges and universities has been started by the Rocky Mountain Committee on Public Utility Information. The plan includes lectures before students and faculties and also classroom study. Where provision could be made actual utility courses have been added to the curriculm. The work began on Jan. 8, when Carl D. Jackson of Madison, Wis., formerly president of the National Asociation of Railway and Utilities Commissioners and former chairman of the Wisconsin Railroad Commission, began a series of lectures that were to include every university in Colorado.

Johnstown (Pa.) Company Seeks to Expand.—The Penn Public Service Corporation of Johnstown, Pa., is seeking from the state commission the right to acquire for $3,500,000 the Warren Light & Power Company, the Jefferson Electric Company and the DuBois Electric and Traction companies, all in western Pennsylvania. When this merger shall have been completed the field of the new company will spread out over nearly a fourth of the state. The main source of power for the system is to be the Clarion River dams, the first of which is now under way. From these dams a network of high-power transmission lines is, according to published plans, to be spread over more than 150 townships in the territory of the Penn Public Service Corporation.

Investment Bankers Take Hand in New Brunswick Power Situation.—Representatives of the Investment Bankers' Association of the United States and the Bond Dealers' Association of Canada waited recently on the Premier of the Province of New Brunswick respecting their request that arbitration be resorted to between the city of St. John and the New Brunswick Power Company for the purchase of the power company's plant. The Premier insisted, however, that the city had a perfect right to erect a civic distribution system in competition with that of the power company and said that "the investors in the New Brunswick Power Company when they purchased their stock or bonds did not acquire with such securities the exclusive right to distribute light and power in the city." It is not thought the government will interfere.

Associations and Societies

Electric Club of Louisville, Ky.—This club has elected the following officers: President, W. W. Crooker; vice-president, Will A. Link; secretary-treasurer, David Schneider; directors, James Clark, Jr., Frank A. Hamel, George M. Miller, A. G. Renau and Samuel B. Storm.

Tri-State Water and Light Association.—The thirteenth annual convention of the Tri-State Water and Light Association, embracing the Carolinas and Georgia, will be held at Birmingham, Ala., on April 17 to April 20, according to an announcement by the secretary, who said that the executive committee had selected the Alabama city because it is proposed to amend the constitution of the association at the approaching meeting to include Florida, Alabama and Tennessee.

Ohio Metermen Convene at Cleveland.—The second conference of the year for metermen of the Ohio Electric Light Association was held Jan. 18 at the Hotel Statler, Cleveland. R. H. Wolford of the Ohio Power Company dealt with "Meter Laboratory Equipment and Maintenance," and W. A. Holliday, Cleveland, with "Field Testing Equipment and Its Maintenance." An exhibit of laboratory and field testing instruments was made by J. L. Wright, chairman of the meter committee.

February Section Meetings of the A. I. E. E.—The following Institute section meetings have been scheduled for February, 1923: Boston, Feb. 13, "Caribou Hydro-Electric Development," A. A. Northrop; Detroit-Ann Arbor, Feb. 9, "Electricity in a Tire-Making Plant," D. H. Baer; New York, Feb. 2, "The Gaseous Conductor Lamp," D. McFarlan Moore; Pittsfield, Feb. 1, annual dinner; Toronto, Feb. 9, "Carrier Current," Mr. Vennes; Providence, Feb. 2, "Seeing but Not Observing," William H. Blood, Jr.; Worcester, Feb. 15, "Interior Wiring," Prof. A. L. Cook.

New Executive Board for American Council.—The executive board of the American Engineering Council for 1923 will, in addition to the officers of the Federated American Engineering Societies, whose names were published last week (page 178), be constituted as follows: American Institute of Electrical Engineers, C. G. Adsit, F. B. Jewett, William McClellan, L. F. Morehouse and C. F. Scott; American Institute of Mining and Metallurgical Engineers, Galen H. Clevenger, Charles H. McDowell and Allen H. Rogers; American Society of Mechanical Engineers, L. P. Alford, A. M. Greene, Jr., John L. Harrington, Fred J. Miller and P. F. Walker; jointly representing American Society of Safety Engineers, American Society of Agricultural Engineers, Society of Industrial Engineers and American Institute of Chemical Engineers, M. G. Lloyd, S. H. McCrory and J. W. Roe; regional directors, A. E. Lindau of Buffalo, W. H. Hoyt of Duluth, Charles H. Gow of Boston, W. J. Fisher of York, Erskine Ramsay of Birmingham, L. A. Canfield of Des Moines, O. H. Koch of Dallas and J. C. Ralston of Spokane.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

New Mexico Electrical Association—Albuquerque, Feb. 12-13. C. E. Twogood, Albuquerque, N. M.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division New York, Feb. 14; general meeting, Hot Springs, Va., March 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Electric Railway Association—Washington, D. C., Feb. 15-16. J. W. Welsh, 8 W. 40th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

American Society of Mechanical Engineers—Montreal, March 28-31. C. W. Rice, 29 W. 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Wills, 403 Slaughter Bldg., Dallas, Tex.

American Society of Mechanical Engineers—Montreal, May 28-31.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Recent Court Decisions

"Danger" Signs Not Sufficient to Absolve Maintainer of Defectively Insulated High-Voltage Wires.—Sustaining a verdict of $30,000 damages awarded in Clumfoot vs. St. Clair Tunnel Company to the plaintiff, an expressman who while engaged in his ordinary work slipped and came into contact with an imperfectly insulated 3,300-volt wire in the St. Clair Tunnel, the Supreme Court of Michigan held that the case rightly went to the jury and that "danger" signs and the victim's knowledge of the nature of his surroundings did not absolve the company from liability in the maintenance of a dangerous instrumentality. (190 N. W. 759.)*

Power of Court Over California Commission's Orders.—In Brewer et al. vs. Railroad Commission of California the Supreme Court of California, deciding that the plaintiff (a water company) was a public utility, declared that, in view of the court's limited power of review, an order of the commission fixing rates cannot be set aside on certiorari because of an error in rulings on evidence, unless this constitutes an entire exclusion of admissible evidence on one side touching the essential issue, amounting to a denial of due process of law, and so ousting the commission from jurisdiction. Such, the court held, cannot be said to be the case where the main substance of that evidence was before the commission in the form of a record of evidence presented in earlier proceedings involving the same issues. (210 Pac. 511.)

Powers of Maryland Commission.—In Benson vs. Maloy an injunction was sought to prevent the abandonment of a street railway line on the authorization of the Maryland Public Service Commission. The Court of Appeals of Maryland, denying the appeal, thus construed the law covering the power of the commission: "It is true that the Public Service Commission, acting under a specially conferred grant of power by the Legislature, exercises only a limited jurisdiction, and where a jurisdiction is so limited it will be strictly construed. The construction to be given, however, must be as far as possible such as to carry out the legislative intent, not to thwart it nor to render its exercise or inability to exercise meaningless and absurd. The argument of the appellant is that an abandonment of a franchise once exercised can only be brought about by a repeal by the Legislature, but how would the Legislature be able to act intelligently in a case like the present? The suggestion is that the allegations of the petition must first go before the Public Service Commission in order that the facts upon which it is based may be found by that body, that such findings shall then be certified to the Legislature, and the franchise, or at least some part of it, repealed, and then such repeal go back to the Public Service Commission. The enumeration of these steps will show the absurdity of any such construction, because if the franchise, or any part of it, is repealed, there is nothing for the commission to act upon. On the other hand, if an effect can be given to the act of 1914 which will plainly carry out the legislative intent without involving any absurdity, that should manifestly be done." (118 At. 852.)

Negligence of Manufacturing Company in Leaving Packing Blocks in Transformer and of Central-Station Company in Not Removing Them Questions for Jury.—Sider vs. General Electric Company and Niagara Falls Power Company was one of the suits for damages growing out of the death of thirteen men in a tower of the Niagara Falls company at Tonawanda, N. Y., on Oct. 31, 1920. The Appellate Division of the New York Supreme Court has confirmed an order of the trial term setting aside a jury verdict of $21,200 as excessive, because of the death of the plaintiff, the sole statutory beneficiary of the victim of the accident, but sustaining the jury in finding for the plaintiff. From this order both the plaintiff and the two defendant companies had appealed, the latter claiming that the verdict should have been set aside on other grounds. The claim for damages was based on the allegations that the manufacturing company had negligently, without proper notice to the central-station company, left packing blocks in transformers which it had sold to the latter, thus making the transformers liable to short circuit, and that the purchaser was also negligent in not making a proper inspection and test of the transformers before putting them into use. The General Electric Company contended that there was no evidence that the presence of the packing blocks caused the circuit and that, even if there had been, the accident was due to the negligence of the power company in failing to remove them. The Supreme Court held that the issue of negligence in both these regards was properly submitted to the jury, declaring that a manufacturer of electric current transformers, knowing that they were to be used to measure a powerful current of electricity, and that to use them with packing blocks left therein would create a very dangerous situation, was called on to exercise care commensurate with the danger, and that where an electric power company purchasing new transformers to measure a powerful current could have turned on a small current at first and increased it gradually, thereby testing the transformers, as was its custom in certain cases, but did not do so, and a short circuit resulted, it was a question of fact for the determination of the jury whether it used care in inspecting and testing them before turning on the full power. (197 N. Y. S. 98.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Special Contracts—Cost of Service.—While asserting that three industrial companies which applied for lower rates from the Southern Sierras Power Company were entitled to a modification of the tariff now charged, the California Railroad Commission reiterated its view that rates set forth in special contracts cannot be upheld by the commission without permitting discrimination, which the law prohibits. It denied the petitioners' contention that rates should be based on cost of service, holding that, however important, this is not the only determining factor. The consumers' own testimony, the commission asserted, showed that in their case the value and not the cost of service is in reality the dominating consideration.

Protest from Telephone Company Against Radiophone Service Overruled.—The Midland Telephone Company protested to the Utah Public Utilities Commission against an application made to that body for permission to operate a radio-telephonic system to provide mutual means of communication for a number of towns and cities which were not interconnected by wire. In granting the application the commission said that the only question to be considered was the necessity of such a service and whether it would serve the convenience of the public. Objections that the enterprise could not be made a success and that such a service would cause damage and inconvenience to a proposed telephone line were held not to be well taken.

Valuation Based on Historic Cost.—In support of the historical reproduction-cost basis as the controlling factor in rate proceedings, the California Railroad Commission said, in the course of its finding in the Pacific Gas & Electric valuation (ELECTRICAL WORLD, Jan. 6, p. 56): "Estimated reasonable historical cost is not the only factor that should be considered in arriving at a proper basis of rates, but we believe it must be the controlling factor, provided resulting rates are within the constitutional limitations. For ten years this commission has followed such a policy, and under that policy utility companies have prospered and are now on a sounder financial basis than they were ten years ago. At the same time, many of the rates they charge are lower today than ten years ago, and considering the state as a whole, but few commodities are as close to pre-war prices as electricity. Careful consideration and reconsideration of the question by succeeding members of the commission has uniformly resulted in the conclusion that this policy is sound, and, what is perhaps more convincing, it has satisfactorily stood the test of time and the extreme conditions that have prevailed in the past few years."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

J. T. Whittlesey Appointed to California Commission

James T. Whittlesey, prominent consulting engineer of San Francisco, has been appointed to a two-year term as commissioner on the California State Railroad Commission. After his graduation from Yale he was with the Thomson-Houston Electric Company from 1889 to 1890. He then went to New York as consulting engineer, and

J. T. WHITTLESEY

in 1892 he entered the service of the Brooklyn street railroad, where he spent four years in the motor department. During the succeeding two years he was chief engineer of the Brooklyn Rapid Transit Company. In 1898 he became superintendent of the Stephenson Car Company of New Jersey. For three years following 1900 he was chief engineer of the United Electric Company of New Jersey and following this held the same position with the Public Service Corporation of New Jersey. In 1912 he removed to California and was retained by the Spreckels interests of San Francisco to advise them on utility matters. During the past five years he has been director of the Pacific Coast branch of the Engineering Business Exchange, with offices in San Francisco. He is a member of the A. I. E. E., A. S. M. E. and American Electrochemical Society.

Philip Harrington has been appointed chief electrical engineer of the Sanitary District of Chicago. After graduation from the Armour Institute of Technology in 1906 Mr. Harrington joined the engineering department of the Sanitary District. He advanced to the post of assistant chief engineer and has had charge of the electrical and of the hydraulic, canal and other departments. His new appointment is part of a plan for the reorganization of the engineering department being carried out by E. J. Kelly, recently elected chief engineer.

Eugene A. Yates, chief engineer of the Alabama Power Company in the construction of Lock 12 and in all projects since the completion of the locks, was last week appointed general manager of the company, according to an announcement made by Thomas W. Martin, president. He succeeds W. N. Walmsley, who has retired owing to ill health. Mr. Walmsley is at present in South America, but on his return will continue to be a vice-president.

J. M. Graves General Manager of Duquesne Company

James M. Graves, assistant general manager of the Duquesne Light Company for more than two years, has been appointed general manager of the company to succeed C. S. Cook, recently made vice-president. Mr. Graves was born at Lexington, Ky., in 1878 and was graduated as mechanical engineer from the University of Kentucky in 1900. In 1903 he became assistant to W. A. Shoreman, chief engineer of the Allegheny County Light Company, and later assistant superintendent of the power stations of the Duquesne Light Company. In 1906 he was made superintendent of power plants, a position he occupied until July 1, 1920, when he was made assistant general manager.

M. F. Riley Heads Potomac Public Service Company

M. F. Riley, who resigned the presidency of the Birmingham Water Works Company to become president of the Potomac Public Service Company of Maryland, as was announced in the Jan. 6 issue of the ELECTRICAL WORLD, is an experienced public utility executive, having been actively connected with the American Water Works & Electric Company's properties for more than twenty-five years. Mr. Riley was educated in Pittsburgh and began his thirty-five years' experience in public utility operation with the Braddock Gas & Light Company of that city. Thereafter for several years Mr. Riley was associated with the American Water Works & Guarantee Company in the general inspection of its waterworks properties. For a period of ten years he had charge of the waterworks property at Little Rock, Ark. For several years prior to 1919 he was associated with the American Water Works & Electric Company in the management and operation of its water properties, and in 1919 he was elected president and manager of the largest properties of that group, among others those of Birmingham and Chattanooga.

Mr. Riley's success as a utility officer and operator is due not only to his long experience and knowledge of business but also to his sense of fairness and his constant purpose to have the public utilities in his charge make the largest possible contribution to the welfare and prosperity of the communities which they serve.

Dr. Fuller Joins General Electric

Dr. Leonard F. Fuller, one of the most prominent radio engineers in the country, has accepted a radio engineering appointment with the General Electric Company at Schenectady, N. Y., and will take up his duties there as soon as work in California under his

L. F. FULLER

direction shall have been completed. He was for seven years with the Federal Telegraph Company, and particularly as chief engineer of that company during the war did important development work on the high-power magnetic arc transmitters which the United States Navy now uses for all transoceanic work. In this capacity he was also charged with executive duties and personally represented the company in negotiations on technical matters with the Navy Department at Washington. Stations designed and built under his direction are used for transmission over some of the longest distances spanned by radio communication.

With C. B. Kennedy, he formed a partnership under the name of the Colin B. Kennedy Company and has been active in the development of the line of radio receiving instruments bearing that name. For several years he has done radio consultation work in the East as well as on the Pacific Coast, and recently he was retained by some of the large power companies of the West to develop and install complete radio telephone transmitting and receiving systems, using 200-mile, high-voltage power lines as carriers. In recognition of his research and development work in radio he received the Morris Liebmann prize for 1919.

G. E. Cullinan Appointed General Sales Manager

George E. Cullinan, who has recently been appointed general sales manager of the Western Electric Company, brings to his new office a background of very broad experience. He entered the employ of the Western Electric Company in 1901 on his graduation from Williams College, and for several years he was in the New York office. In 1907 he was sent to St. Louis and was manager there from 1909 to 1918, going then to Chicago as the central district manager with supervision over and responsibility for the Chicago, Detroit, Minneapolis, St. Paul, Duluth, Omaha, Indianapolis, Louisville, Cincinnati, Columbus and Cleveland branch houses.

G. E. CULLINAN

Mr. Cullinan brings to his new work a particular fitness because of his broad contact with the national problems of sales and distribution. He is gifted with a genial personality and the ability to make and hold friends.

Mr. Cullinan was born in Geneseo, N. Y., 1878. He is a member of the executive committee of the Chicago Chamber of Commerce and a director of one of the Chicago banks.

Society for Electrical Development Increases Staff

Albert Kapteyn joined the staff of the Society for Electrical Development at the close of 1922. His work with the Westinghouse Machine and Air-Brake companies, supplemented by considerable experience in export work, especially fits him for the making of original studies and the preparation of booklets. W. W. Ayre, another new appointee, has been with the McGraw-Hill Company, the advertising department of the Western Electric Company and the Tucker Advertising Agency and was more recently managing editor of the Publishers' Autocaster Service in New York. Mrs. Harriett C. Emmons has been added to the staff to assist in organizing and fostering home economics work. W. S. Sands has also allied himself with the society.

Norman Perry of the Indianapolis Light & Heat Company has been elected president of the Electric Appliance League of Indianapolis.

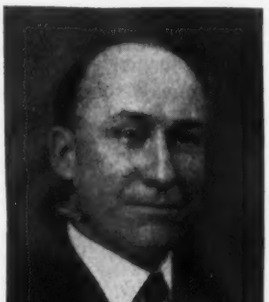
R. U. Mussley, formerly superintendent at Bellingham for the Puget Sound Light & Power Company, has been made manager of the properties which were purchased by that company from the Washington Coast Utilities Company.

Clarence T. Ward, office attorney and secretary of the Idaho Power Company and the Boise Valley Traction Company for four and a half years, has resigned, and will open offices in Boise for the general practice of law. A. J. Priest, graduate of the University of Idaho law school, has succeeded Mr. Ward.

F. R. Wadleigh has been designated by the President to succeed Conrad E. Spens as federal Fuel Distributor. Mr. Wadleigh has been chief lieutenant to Mr. Spens throughout the latter's administration. He also is continuing to fill the position of chief of the coal commodity division of the Department of Commerce.

Dr. F. C. Brown Made Acting Director of Bureau of Standards

Dr. Fay C. Brown, assistant director of the Bureau of Standards, was recently designated by Secretary of Commerce Hoover as the acting director of the bureau to conduct its work until a director shall have been chosen. In addition to his administrative duties in connection with the Bureau of Standards, Dr. Brown has done a great deal of research work, including special studies in thermionics and optical work, and he has made an intensive study of the electrical and mechanical properties of selenium and selenium crystals. Dr. Brown was born in Washington, Ohio, in 1881 and was graduated from the University of Indiana in 1903. He did graduate work at the University of Illinois, the University of Chicago and at Princeton. He became an instructor in physics and engineering at the University of Illinois and later joined the faculty of the University of Iowa. When the United States entered the war he was assigned to the Ordnance Department of the army and placed in charge of the testing and ballistic work on airplane bombs. While in the military service he attained the rank of major. At the end of the war Dr. Brown had the opportunity to choose between the professorship of physics at the University of Iowa and the position of assistant director of the Bureau of Standards. He accepted the latter post, where he has been engaged continuously since.



F. C. BROWN

Obituary

Walter F. Brown, general traffic manager of the Mountain States Telephone & Telegraph Company, Denver, died of pneumonia on Jan. 17, after a few days' illness. Mr. Brown, who was elected president of the Colorado Public Service Association last fall, became identified with the Bell Telephone System in New York City in 1893, and several years afterward he was transferred to Colorado.

Jacob S. McFerren, prominent banker and manufacturer of Hoopeston, Ill., died Jan. 7, at Chandler, Ariz., where he had gone to spend the winter months. Mr. McFerren was prominently identified with the canning industries of Hoopeston and also with the lumber interests of the South. He, with A. H. Trego, installed the electric lighting plant in Hoopeston, since absorbed into the Central Illinois Public Service Company. He also introduced the telephone business into Hoopeston.

H. G. McConnaughty, who had recently been associated with the Edison Electric Illuminating Company of Boston, died of heart failure on Sunday, Jan. 21, after a long illness. During the war Mr. McConnaughty acted as an assistant on the national fuel board. He was at one time exhibit director of the American Electric Railway Association and subsequently of the National Electric Light Association.

Arthur M. Beveridge, for the past four and one-half years New England district manager of the Eureka Vacuum Cleaner Company, with headquarters at Boston, died Jan. 10 after a short illness. Mr. Beveridge was one of the ablest men in the appliance sales field in the East and had a host of friends in New England central-station and retailing circles. He was a member of the Merchandising Bureau of the New England Division, National Electric Light Association.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Pros and Cons of Buying Spare Parts*

What the Local Foundry Has to Offer as Compared with the Distant Manufacturer of the Equipment

BY C. E. HARRISON
Manager Service Department
American Engineering Company, Philadelphia

AN IMPORTANT part of a manufacturer's service to the industries which he supplies with equipment is the provision for prompt shipment of spare parts upon receipt of orders from users. The practice sometimes adopted of ordering parts from local sources other than the original manufacturer is susceptible to objections from the manufacturer's standpoint, although arguments in favor of local buying are also available. Let us analyze this matter from the point of view of the mechanical-stoker user and manufacturer in relation to the supply of spare parts.

There are five points in favor of the local foundry:

1. *Local Relations.*—Business, political and personal relations can only be offset by good service and salesmanship.

2. *Lower Price per Pound.*—This will as a rule only apply to some of the easily made and weighty parts and usually those parts that do not require machine work.

3. *Saving in Freight.*—This is a direct saving and presents an unanswerable argument.

4. *Quicker Delivery on Small Orders.*—We must grant the fact that in an emergency, a local foundry can make a small part in less time than a duplicate can be received from a service station, provided that a mold can be made from the piece itself or that a pattern is at hand.

5. *Opportunity to Make Changes.*—Almost every stoker operator has at some time the desire to change a part and can very readily do this when having his parts made locally.

Against these there are nine points in favor of purchase from the original manufacturer:

1. *Incentive.* — Aside from the monetary remuneration, the manufacturer's continued success depends to a great extent on the field reports on his equipment. It is therefore necessary that these reports be as favorable as possible, and to this end the very best value and service must go with his sales of spare parts.

2. *Service.*—It is so self-evident that the manufacturer is in a far better position to render service than is the local foundry that further comment is unnecessary.

3. *Better Material.*—The manufacturer is in a position to determine the best material for the requirements of stoker service. He also is in a position to use this material, for he pours a sufficient quantity. The local foundry, on the contrary, must run a general all-around mixture, and as it is competing on a price basis without a constant demand, this means spot iron with its high sulphur or phosphorus content and larger portion of scrap than is advisable.

4. *Interchangeability.* — This best can be assured when replacement parts are made from the same patterns as the original. Even then it requires constant inspection and numerous changes and adjustment to keep the product uniform. Only those who have followed quantity production can realize the difficulty of maintaining a constantly uniform and interchangeable part. Machine molding by eliminating the personal equation materially assists in securing the desired result. Gages, jigs, fixtures and all other aids to uniform production can be afforded only by the manufacturer.

5. *Improvements.*—Only the constant user of parts service secures the benefit of improvements. The man making his own parts remains in ignorance of the advances that have been made. Even if these are called to his attention, he may be unable to change over owing to large stocks on hand or the prohibitive cost of pattern or method changes.

6. *Stock-keeping Costs.* — These will vary between 10 and 20 per cent. This difference is made up of factors such as interest on investment, labor, hauling, light, heat, power, stationery, space charges, depreciation of market value, depreciation due to age and depreciation due to advancement of the art rendering stock parts obsolete. When the original manufacturer renders good service by shipping promptly and by the establishing of local service stations, this cost can be kept down materially —in some cases to one-fourth the cost experienced when purchasing parts locally, for the foundry making parts must regard the work as temporary and used only to fill in during slack times. It, therefore, invariably requires a great deal of time to fill the average order and seldom, if ever, maintains a stock. The original manufacturer can maintain a stock to protect amply five hundred plants at a much lower cost than those five hundred plants could carry an individual stock affording the same protection.

7. *Benefit of Experiments.*—The original manufacturer with the resources at his command and data from hundreds of plants has the ability and competition provides the motive to be constantly striving to better his product.

8. *Quantity Manufacture.* — A phrase to conjure with—the basis of American business. It means not only lower costs, but a uniform and better product, for on this basis only can the maker warrant the expenditure to insure a uniform and better product. It permits the purchase of quantities of materials on rigid specifications and makes it possible to see that these specifications

*From a paper on "Service," presented at the convention of the Stoker Manufacturers' Association at New London.

have been met, to employ manufacturing methods and special tools that turn out a product within a tolerance impossible to attain by job-shop methods, and to afford the purchase and use of limit gages and inspections that insure the shipment of a product in absolute accordance with the original design.

9. *Most Value for Dollar.*—The cheapest is practically never the best. It is built down to a price rather than up to a standard. Cast iron is not cast iron any more than coal is coal or oil is oil.

Why not consider the cost of lost production due to shutdown, extra boiler hours off the line, extra installation costs and the multitude of extra cost items occasioned by the failure of locally made parts? One such failure will cost more than can be saved in a year's purchases.

The original manufacturer has every reason to encourage such analysis and can rest assured that, if fairly made, it will demonstrate the purchase of original parts to return to the purchaser the most value per dollar spent.

Radio—A Pacific Coast Analysis

How the Jobber Has Come Into the Picture—The Problem of the Department Store—The Present Inadequacy of Broadcasting in the Far West

ALMOST every electrical dealer in each community now carries radio equipment. Down Main Street is a barber shop which handles it as a side line; the music stores all feature it, and at least two department stores have special sections devoted to it. Then, of course, there are seven or eight radio specialty shops, all the hardware stores, two cigar stores and a grocery shop.

This is the retail side of the story. Following it back a little further, one finds something like fifteen jobbing houses in various lines distributing the goods wholesale, four or five of them in the electrical field, an equal number of hardware jobbers, automotive jobbers, music jobbers, one or two radio jobbers, some of whom have retail departments, one or two dealers who have jobbing departments, several manufacturers who have every variety of department, and, as always, the department store.

As for manufacturers, if there is an idle machine shop, sewing-machine factory, garage or shipyard in the country which is not manufacturing some radio part, it is not on this section of the coast. Aside from the "bootleggers," there are also the legitimate manufacturers who are not infringing on anybody's patent and who have some measure of financial responsibility.

THE ADVENT OF THE JOBBER

Until six months ago there were comparatively few wholesale channels for radio equipment in this Far Western country. Much of the business was by mail order. The few large retail concerns which were first in the field took practically the entire manufacturer's output, and it was a simple matter for him to deal direct with them and either to pass by other business which sought to enter the field or to accept it upon due financial investigation. But the business has been in the process of growing overnight from a laboratory experiment to a national sport. The popular demand enticed everybody into it, and the manufacturer, who started to deal with all alike upon a one-price, small-discount basis, was forced to realize that he needed a jobber's service. In the unforeseen hurry of the emergency he took what was at hand, and the radio dealer-jobber and jobber-dealer came into existence.

More recently the electric jobbing houses and hardware jobbing houses of established reputation have taken over these lines, and the tendency is more and more for the manufacturer to take advantage of these standard channels of distribution. The jobber's service is a financial one as well as a local merchandising and warehousing one, and it is a great advantage to the manufacturer to have the wholesaling of his product in the hands of financially well-established concerns.

Discounts are no longer the sore point that they were and the tendency is for the manufacturer, under the pressure of a slower market, to allow for a reasonable wholesale margin. Fixed policies are probably not to be expected until the market has worked itself into something like stability.

Within the wholesale group itself are policies still awaiting settlement. Some have accepted one manufacturer's line only, on the theory that they handle only one line of other types of electrical equipment. Other firms have departed from this principle in handling radio goods and are prepared to furnish almost every make of equipment which is on the market.

One aspect of the situation which is a thorn in the side of all concerned is the participation of the department store in the game under present conditions. It means the ruin of the market for the small dealer, who often pays more for his goods to the wholesaler than the sale price at which they are offered over the department-store counter.

DEPARTMENT STORE PROBLEM

There are seemingly two methods of escape from this predicament—one the hope that the department store can be persuaded to play the game along the lines which have been shown to be sane merchandising practice, the other that the standard manufacturers will look upon these channels as outlawed and, by allowing no special margins, leave the department store exclusive rights to such lines as it is able to acquire upon other terms. The more hopeful effort, however, is directed toward the possibility of bringing the department store into co-operation with all other interests in the field. The tentative program outlined at the recent meeting of the advisory committee of the California Electrical Co-operative Campaign by which membership in that body will be open to all in the electrical merchandising business who subscribe to its tenets offers an opportunity of interesting the department store in the general "betterment-of-the-industry" movement, which perhaps promises more than any other existing tendency.

The greatest difficulty with the radio business on the Pacific Coast at the present time is the broadcasting situation. In the major Eastern cities and in certain other localities in the Middle West and in the South adequate broadcasting centers have been established where the power back of the station insures clear-cut signals and the character of the entertainment is maintained at a high level. There is no such satisfactory situation on the Pacific Coast. The publicity advantages of broadcasting have attracted many, and there are some sixty-odd centers

established, many of them with capacities so small that they cannot be heard clearly even in their own communities. A victrola and a selection of jazz records complete the equipment, with results which offer little attraction to any one but the amateur experimenter interested in the scientific novelty.

The Western industry is fully alive to the need for immediate improvement, and local interests are endeavoring to bring it about. The answer to all of these problems lies in the adoption of sound merchandising principles in every department of radio merchandising and the clearing up of the distribution situation. The present troubles of the radio business lie not with radio but with business, and the sooner this is realized and policies determined, not by the exigencies of the moment but by careful consideration of the future, the sooner will they cease to be a thing to worry about.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Demand for Signal Apparatus Is Improving

Without any spectacular features, the demand for signal apparatus is improving decidedly as compared with a year ago, and distributors of this class of equipment are busy with sales to owners of new buildings in many parts of the country. Schoolhouse construction is responsible for a healthy portion of this trade, but new apartment houses, residences and changes in manufacturing and mercantile establishments in the interest of greater efficiency are reflected in recent orders. Manufacturers are able to make good deliveries in this line, as a result of long-established coordination of raw material supply and plant facilities, but a good deal of effort has to be expended upon securing steel products which enter into signal apparatus, as in many other lines utilizing this class of raw material. In a representative manufacturing plant deliveries of signal equipment can be made in three weeks from receipt of order. Prices are firm and have shown no tendency to change for some months.

Conduit Boxes in Easy Supply

Despite the difficulties reported in some sections of the country in securing rigid conduit for jobbers' stocks, the supply of conduit boxes on hand at the beginning of this week was reported as highly satisfactory. The relatively small number of these outfits used in connection with any particular wiring job as compared with the length of pipe required has long been a factor permitting the maintenance of adequate stocks in distributors' hands. The fluctuations in the demand for pipe which have been noted during the past year or two have been correspondingly "dampened" by the time they have reached the conduit-box bins. At present the increase in building trade activities in different parts of the country is stimulating a healthy demand for boxes. Prices are firm and tend to follow the general movement of steel-product quotations, with more or less lag behind the active changes on account of the relatively staple stocks noted above.

Electric Furnace Business Showing Activity

Considerable increased activity is reported for the electric furnace field.

The Electric Furnace Company, Salem, Ohio, announces that it has recently sold to the Columbia Tool Steel Company, Chicago Heights, two 100-kw. annealing furnaces. These furnaces are especially adapted to handle long bars of tool steel in boxes, with the temperature under automatic control. Other recent installations of interest are as follows: One for the Auto Strop Safety Razor Company, New York City, which consists of two furnaces adapted for heating lead baths through which razor-blade steel is drawn for treatment.

Hadfields, Ltd., of Sheffield, England, are installing a 360-kw. car-type electric furnace for the heat treatment of manganese steel castings.

The Metal & Thermit Company has purchased another furnace for its East Chicago plant, a duplicate of one made over a year ago, excepting as to size, the new unit being of 250 kw. capacity. This furnace will be used for special treatment of oxides, which are supported on a double firebrick hearth.

Besides the above-listed heating furnaces there have been additional installations made for the Buick Motor Company of Flint, Mich., of a third furnace for melting brass; for the Ohio Injector Company, Wadsworth, Ohio, of a 105-kw. brass-melting furnace; a 75-kw. furnace for melting brass for the Hammond Brass Works, Hammond, Ind.; a 75-kw. brass-melting furnace for the American Stove Company at Bedford, Ohio, and another furnace with special automatic control has just been shipped to the American Stove Company's Cleveland plant for the calorizing of stove chimneys.

Switch Sales Are Reported 50 per Cent Heavier

Present sales of inclosed switches are running approximately 50 per cent greater than they were twelve months ago. According to one manufacturer in the Middle West deliveries are not very good and the outlook for the coming three months is not encouraging.

In giving his opinion of the business in switches for the next six months of the year, another manufacturer, also in the Middle West, says: "We feel that business for the next six months will be better than it was for the first six months of last year, but we do not anticipate any great increase. Our opinion is based on the fact that there is going to be a great deal more industrial building during the first half of 1923 than there was during the first half of 1922 and a great increase in the use of the standardized service switch.

The switch business in Canada has also increased greatly during the last six months, but conditions are not healthy. According to a manufacturer of Toronto, Ontario, manufacturers apparently are fighting for business to keep their factories going. It has resulted in a great decrease in price with little prospect of early betterment. There are really more manufacturers in the business than there is business to be had. The outlook for the next six months is fairly good. This assumption is based on the number of building permits that have been taken out since the first of the year, and the program as a whole seems to be fairly extensive compared with the two former years.

The Metal Market

Copper at 14.62½ Cents—European Sales Are Quiet—Lead Supply Continues Low

Copper prices have been shaded so that now the quotation of 14.62½ cents, delivered, prevails. Although the tense European situation has not yet had any direct influence on the market, it is evident that producers are somewhat worried over the outlook for German purchases of copper as an important factor in the export trade. European sales of copper have been quiet, England remaining practically out of the market. The consolidation of Anaconda and Chile Copper, as last officially announced, has not had any stimulating results on prices, probably because the amalgamation had been known and discounted by the trade for several weeks. The new arrangement does not alter the copper situation, as it neither adds to nor subtracts from the amount of metal that is available for consumption. A sale of a good-sized lot of copper for delivery through the second half of the year at 14.75 cents, delivered, was an interesting feature of the week. This is said to be one of the largest sales of copper since the war, estimated to be more than 36,500,000 lb.

The official contract price of the American Smelting & Refining Company for lead continues at 7.50 cents per

pound, New York. The shortage in lead continues. A measure of its acuteness is to be found in the great variation to be observed in the prices quoted for lead not only in the New York market but in that at St. Louis. In New York by far the greatest amount of lead was sold at 7.50 cents, although quotations have been as high as 8 cents. One large producer sold merely a handful of lead during the week as his stocks are exhausted and he has made all the commitments he cares to for the time being.

NEW YORK METAL MARKET PRICES

	Jan. 17, 1923 Cents per Pound	Jan. 24, 1923 Cents per Pound
Copper		
Electrolytic	14.75	14.62½
Lead, Am. S. & R. price	7.40	7.50
Antimony	6.35	6.75
Nickel, ingot	36.00	36.00
Zinc, spot	7.00	7.00
Tin Straits	38.87½	38.62½
Aluminum, 98 to 99 per cent.	23.00	23.00

Collections in St. Paul and Minneapolis Very Slow

Collections in the St. Paul and Minneapolis territory are very poor, according to several manufacturers and jobbers. Minneapolis reports that the amount of its cash business generally has grown to large proportions, while St. Paul credit men say that a very large percentage of retail business is also for cash. The whole territory suffered heavily last fall from the car shortage. Large crops of perishable products, mostly potatoes, rotted away for lack of cars. This condition had a deadening effect on collections, and accordingly extensions were not granted. Outstanding obligations were covered by notes and other forms of security, and rural business was put on a cash basis.

Sales of Canadian Fixtures Active, with Firm Prices

Prices of Canadian fixtures during last year remained quite steady. There were no changes of any consequence, although there were of course a few fluctuations. Canadian manufacturers do not look for any great change in prices during the coming year, and, if any, they believe the trend will be slightly to increase prices.

During 1922 deliveries of Canadian fixtures were a little slower on the whole when compared to the deliveries during 1921 and 1920. It is the opinion of a fixture manufacturer in Hamilton, Ont., that supplies will be able to keep up with the demand of 1923 owing to improved conditions in transportation of raw materials.

A leading manufacturer of fixtures in Canada states that his sales during the last half of 1922 were considerably better than during the first period of that year.

Indications are that business will be fairly brisk during the next six months because of large construction programs.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

CONSTRUCTION programs throughout the United States indicate an unusually heavy amount of business for manufacturers of all electrical material entering into new buildings both residential and industrial. Brief summaries of activities in leading cities of the country report greater activity by central-station companies in the purchase of material for line extension and repair work. High-tension business in Chicago remains brisk and manufacturers are kept busy supplying certain large orders. Because of continued winter construction conduit boxes are in steady demand, with firm prices and normal stocks. A slight falling off in the demand for meters is noted. Radio buying is said to be on a firmer basis because purchasers are now showing a growing tendency to buy complete sets rather than scattered parts. Among other general features of the week are a change to lower stocks of wire, firmer conduit prices, a steady call for fuses and a slight falling off in the demand for motors.

New York Manufacturers and jobbers report an improvement in business. All wire and other materials entering into new construction are moving in satisfactory volume. Inventories generally are completed and orders from retailers are reported to be conservative and of wholesome character. Demand for motors is slower, stocks are normal and the price trend is firm. Meters continue slow. Central-station purchasing shows a little improvement. The appliance market is without feature and is not expected to take on any growth until spring. A turn in the radio market is for complete sets built by skilled engineers in preference to many parts, which when assembled by the average amateur, guided by inadequate instructions, are inefficient and bulky. Prices generally are firm.

Chicago Jobbers report business steadily climbing with increase in number of January building permits. New construction requires a steady volume of wiring materials, and wire prices have an upward tendency. Conduit supplies, especially in the smaller cities, are still low. High-tension manufacturers are busy. One company sold one 1,500-kva., 14,000-volt substation for the Middle West and two 600-kva., 33,000-volt substations for the Southwest. Another firm handled an order for 4,000-volt substation equipment for a Middle Western utility. A steady volume of high-tension fuses is flowing out from another concern.

Boston Business is less brisk, but the underlying tone is excellent. Deliveries are giving considerable trouble, and a severe shortage of rigid conduit was reported Monday, with tendencies toward stiffer pricing on filling orders. Manufacturing is progressing well in New England, and jobbers are buying appliances to overcome the shortage experienced at the end of the year. Building operations are well sustained, and favorable rates for money are encouraging the consideration of many new projects. Cotton and rubber prices rose to new peaks last week and copper tended toward weaker quotations. Central-station business continues to gain, as do traction earnings, and the demand for telephone service is remarkably active.

Atlanta The spirit of optimism which ushered in the new year becomes more evident every day, and one hears that 1923 will be a record year. Municipal improvements in Atlanta under the bond issue of last spring have finally got well under way, and this has resulted in a high percentage of employment among the artisan class as well as in the ranks of common labor. This is reflected in the improvement of retail sales in this city. Good sales are reported by electrical jobbers and dealers, despite the usual after-Christmas lull.

Pittsburgh Jobbers are finishing inventories and again are placing orders for stock. Jobbers and their salemen generally are optimistic as to future business. The steel industry is steady, although production could be increased to a great extent if the car shortage were eliminated. Weather-proof wire advanced slightly last week. Rubber-covered is firm. One manufacturer of armored cable has made an advance and others are expected to do likewise in the near future. Low stocks of pole-line hardware have been somewhat relieved by the opening of another plant in this territory by one of the largest manufacturers. The demand for radio shows a slight increase and seems to be settling down to a merchandising position. Among the features of the week is the change to lower stocks of wire, firmer prices for conduit, steady call for fuses with increasing prices, and a falling off in the demand for motors.

St. Louis Records of building permits for last year indicate that construction work in St. Louis exceeded that done in the year 1921 by approximately $10,000,000, which is an increase of more than 50 per cent. The construction work for manufacturers and other shops during this period shows an increase of about $1,000,000, more

Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fifteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Storage Batteries, Farm Lighting Plants and Tools

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Conduit Boxes	Cooking Appliances	Signal Apparatus
New York																		
Demand	Act.	Sdy.	Sdy.	Slow	Slow	Slow	Slow	Slow	Sdy.	Spy.	Sdy.	Sdy.	Act	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Hi.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml
Price trend	Firm	Firm	Inc.	Firm	Firm	Firm	Dec.	Firm	Inc.	Firm	Firm	Inc.	Firm	Dec.	Firm	Firm	Firm	Firm
Chicago																		
Demand	Act.	Act.	Act.	Sdy	Sdy.	Slow	Slow	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Boston																		
Demand	Act.	Sdy.	Act.	Slow	Slow	Slow	Slow	Slow	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Act.	Sdy.	Slow	Act.
Supply	Nml.	Nml.	Low	Low	Nml.	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Low	Hi.	Nml.	Nml.	Nml.	Nml.
Price trend	Firm	Firm	Inc.	Firm	Firm	Dec.	Dec.	Firm	Inc.	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm	Firm
Atlanta																		
Demand	Act.	Slow	Act.	Sdy.	Act.	Act.	Act.	Slow	Act.	Slow	Act.	Act.	Act.	Act.	Slow	Act.	Act.	Slow
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Cleveland																		
Demand	Act.	Sdy.	Act.	Slow	Slow	Slow	Slow	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Slow	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Nml.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Pittsburgh																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
St. Louis																		
Demand	Sdy.	Sdy.	Sdy.	Act.	Slow	Slow	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Slow	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Slow	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
New Orleans																		
Demand	Act.	Sdy.	Slow	Sdy.	Act.	Act.	Slow	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Sdy.	Slow	Act.
Supply	Low	Nml.	Low	Nml.	Low	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.
St. Paul-Minneapolis																		
Demand	Sdy.	Slow	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Sdy.	Slow	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Salt Lake City																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Sdy.	Sdy.	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Hi.	Nml.	Nml.	Low	Hi.	Nml.	Nml.	Nml.	Low	Low
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Inc.	Firm	Firm
Denver																		
Demand	Act.	Act.	Act.	Slow	Slow	Act.	Act.	Slow	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Slow	Act.	Slow	Sdy.
Supply	Nml.	Nml.	Low	Low	Nml.	Low	Low	Low	Hi.	Nml.	Low	Nml.	Hi.	Hi.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Inc.	Firm	Firm
San Francisco																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.	Slow
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Inc.	Firm	Firm
Portland-Seattle																		
Demand	Sdy.	Slow	Act.	Act.	Act.	Sdy.	Slow	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Slow	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Low	Nml.	Nml.	Nml	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Inc.	Firm	Firm

than 85 per cent higher than during the previous year. The first three weeks of 1923 have been marked by great enthusiasm among the electrical wholesalers and retailers. The better business experienced in the latter part of 1922 is continuing, and prospects for the year are very bright. There is an absence of speculative purchasing by retailers, and continued replenishing of depleted stocks indicates a healthy business condition.

Cleveland

Orders of the week were of the nature to indicate that dealers were rounding out stocks in anticipation of an active spring. Dealers are "shopping around," and while prices are firm in the main, no advances are evident. Manufacturers report only a mediocre week in sales, but jobbers review it as satisfactory. Credits are easier, but deliveries are lengthened somewhat by shipping difficulties. Industrial equipment was more active, with particular strength in motors. Conduit boxes are in good demand, but orders are promptly filled and firm prices prevail. Appliances generally are suffering a post-holiday depression, although washers are selling in fair volume.

New Orleans

Business during the week has shown a noticeable improvement. A feature of the week has been the change in demand for wire from slow to active. Prices of armored cable are said to be increasing. Demand for transformers has changed to a steady gait, and stocks generally are normal with firm prices. Porcelain stocks are again normal and firm prices prevail. Business in switches is somewhat slower than last week as demand has changed from active to steady, stocks are normal and prices generally are firm. Motor stocks also are improved.

St. Paul-Minneapolis

Twin Cities business changed little from the even strides of last week, although orders are slightly smaller in St. Paul. A greater demand by the central stations for equipment to be used in extensions and repairs is reported. Radio buying continues active. Appliance business is slow, and some dealers expect price declines. House wiring is noticeably slower. Fixture demand remains active. Jobbers plan large spring campaigns. Fixtures are more active than last week. The price of conduit is more firm, although stocks are low. Demand for meters has changed from an active condition to a steady one.

Salt Lake City A four-million-dollar bond issue has been sold by the Columbia Steel Company for erection of plants in Utah. This is believed to be the beginning of extensive coal and iron developments in this section of the Intermountain West. The National Wool Growers' Association has just finished a convention here, and the wool and mutton industries were reported to be in excellent condition. Most growers are said to be well on the way toward recuperation. Statistics just compiled show a million-dollar increase in building in Salt Lake City in 1922 over 1921. A larger gain is forecast for 1923. Jobbers and retailers report business rather slow for this time of the year. Collections are improving steadily.

Denver A program of continued building indicates an early demand for a wage increase by all building trades. It is stated the electrical union will ask for an increase of one dollar a day above the present rate of $8 for eight hours. No action has been taken by any of the master contractors. Some jobbers believe that if an increase in wages is granted, along with the increasing costs of other materials, prosperity in this section will be somewhat affected. Most inventories are over and stocks are being added to. Central-station buying is active.

San Francisco Business in building industry continues at a high rate, but store sales have fallen off. Electrical orders from the railroads are excellent and will increase considerably when large constructive programs of various lines commence within the next few months. Southern Pacific has authorized the expenditure of $12,000,000 for new equipment alone. The year's combination of bumper crops and car shortages when transportation facilities were needed most caused considerable loss to fruit growers. Radio sales have gained considerably since the opening here of a large new station, which is said to have cost over $20,000. Conduit box prices have recently increased about 10 per cent. Five thousand electric ranges will be sold during the present year, it is estimated.

Portland-Seattle Jobbing business is active for this time of year. Conduit, safety switches and wiring devices apparently are moving more freely than other lines. General opinion is that prospects for a good business year are excellent. Inquiries at present are most active from lumber mills and railroads. Many buildings are planned for early construction in cities throughout this section. Conduit boxes are in steady demand, with orders averaging from 100 to 200 boxes each. Cooking appliances are moving more slowly since the holidays, but a recovery is expected by early spring. There is little demand for signal apparatus in this section and heavy orders are few.

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Rauch & Lang Receive Order for More Electric Taxis

The Rauch & Lang Company, Chicopee Falls, Mass., reports an increased demand for taxicabs, a line undertaken by this concern last year in addition to the manufacture of electric vehicles for ordinary passenger use. The Electrotaxi Company of New York, which has a fleet of eight Rauch & Lang electric taxis, has ordered ten more for early delivery. Aside from taxicabs, the company reports that its business is 25 per cent better than a year ago.

Results of Geier Sales Contest

The idea of the electric cleaner as a holiday gift was the keynote of the successful Royal sales contest, results of which have just been announced by the P. A. Geier Company. The thirty-three winners were widely distributed throughout the country. The first prize of $500 went to Alexander Mueller of Los Angeles, and second prize, $450, to Raymond M. Uber, Philadelphia.

Record-Size Frequency-Changer Set Ordered from Westinghouse

The Brooklyn Edison Company has recently purchased from the Westinghouse Electric & Manufacturing Company a frequency changer set of 35,000 kva. capacity for installation in its Gold Street station. The set is larger than any frequency-changer set now in service in the United States and has over-all dimensions, including the direct-connected exciter, of approximately 47½ ft. length, 22 ft. width and 15 ft. height. It is expected that the set will be in operation by November, 1923.

The set, which operates at 300 r.p.m., will connect the company's 25-cycle and 60-cycle systems, transforming energy from 13,800 volts, three-phase, 60-cycle, to either 6,600 volts or 11,400 volts, three-phase, 25-cycle. The 60-cycle end of the set is connected directly to an auto-transformer, through which the voltage is stepped up from 13,800 to 27,600. At this latter end a tie line, running underground in three-phase lead-covered cables, will connect the set with the power house which the Brooklyn Edison Company is erecting at Hudson Avenue.

The set is arranged for starting from either end. For the 60-cycle end starting taps are provided on the auto-transformer, and for the 25-cycle end it is proposed to connect the set directly to a generator in the station while the latter is at rest and to bring both the generator and the frequency-changer set up to speed together. No starting motor is provided. Excitation for both ends of the set is obtained from a common exciter of 300 kw. capacity. Hand regulation will be used for both ends of the changer.

Pacific Coast Jobber Announces Largest "Ad" Campaign in West

The Pacific States Electric Company, one of the largest electrical jobbers on the Pacific Coast, with branches in all large Western cities, has announced an advertising program for 1923 to promote its "Check Seal" campaign, which will be the largest advertising campaign ever put on by a concern of any kind in the West. The "Check Seal" slogan, standing for higher standards in electrical contracting, had its inception in Los Angeles in September, 1921, and proved so successful there that it was carried to all of the large cities of the West.

The plans for 1923 call for extensive newspaper advertising and billboards throughout California, Oregon and Washington. The program consists of two full-page and eight 1,000-line newspaper advertisements, to be alternated with the billboard displays throughout the year. The two full-page advertisements feature the "Check Seal" standards of installation in relation to power development. The other eight advertisements feature the "Check Seal" as a guide to standard electrical materials and qualified electrical contracting service in both industrial and domestic installations. In addition to 415 poster panels in full color, nine de luxe illuminated billboards will broadcast the story and direct public attention to "Check Seal" contractors.

Sprague to Campaign Against Misuse of Its Trademark

In order to correct the misuse of the trademark "BX," the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City, manufacturers of steel-armored conductors, will soon start a campaign to curb this practice. In a statement to trade publications this company states:

"Steel-armored conductors were first introduced to the trade by the Sprague Electric Works under the trademark 'BX' more than twenty-five years ago. In a short time this trademark had become universally known, and by the time the first competitive make of armored conductor appeared on the market 'BX' had become synonymous with armored conductor or cable. The title 'BX' was loosely applied to any

make of armored conductor, and the misuse of the Sprague trademark gradually became general.

"In an endeavor to correct this condition, the Sprague Electric Works are carrying on a campaign of education. One measure adopted is the use of an orange and blue tag which will be attached to every coil and will distinguish 'BX' from other makes.

"'BX' is the registered trademark of the Sprague Electric Works and cannot be legally applied to armored conductors of any other make."

What Anaconda-Chile Copper Merger Means

A special meeting of the stockholders of the Anaconda Copper Mining Company has been called to meet at Anaconda, Mont., Feb. 26, for the purpose chiefly of completing the acquisition of the Chile Copper Company, notice of which appeared in last week's issue. So extensive is the field of the activities of the Anaconda Copper Mining Company that it possesses not only the greatest capacity in the production of copper, but through its rolling-mills department and the American Brass Company it is the premier manufacturer of copper and brass products in the world. The company's reduction works at Anaconda have a normal output amounting to 13 per cent of the copper produced in the United States and about 9 per cent of the world's total production. A modern refinery at Great Falls, Mont., has an average annual capacity of 216,000,000 lb., while a refinery at Perth Amboy, N. J., has an annual capacity of 450,000,000 lb. The rod and wire mill at Great Falls turns out annually 90,000,000 lb. of manufactured copper, while its electrolytic-zinc plant at Great Falls is the largest of its kind in the world.

A year ago the Anaconda Copper Mining Company acquired the stock of the American Brass Company, which gave the Anaconda Copper Mining Company a definite outlet through which its metals found their way directly to the various industries. The American Brass Company now produces at the rate of 450,000,000 lb. per annum, and its consumption of copper, together with the requirements of the Anaconda Company's own fabricating plants, is in excess of the present copper production of the Anaconda Copper Mining Company and the Chile Copper Company. The Chile Copper Company, the control of which has just been acquired by the Anaconda Copper Mining Company, possesses the most extensive and one of the most valuable of the known bodies of copper ore in the world. The mines of the company are in the Province of Antofagasta in Chile and enjoy many natural advantages, including proximity to ocean transportation, adequate supply of labor and immense tonnage near the surface. The mines are equipped with electric and steam shovels capable of moving 43,000 tons or more a day. A modern power plant is established at Tocopilla, from which a 100,000-volt, three-phase, 50-cycle, 87-mile transmission line runs to a plant at Chuquicamata. The Chile Copper Company is the lowest-cost large-scale producer of copper in the world. Its present production is at the rate of 180,000,000 lb. of copper per annum, and extensions now under way provide for increasing that production to a rate of 225,000,000 lb. per annum by spring.

The purposes of the consolidation were explained to a representative of the ELECTRICAL WORLD by Cornelius F. Kelley, president of the Anaconda company, at its office in New York. It was stated that electrical manufacture and transmission and telegraphic and telephonic communication absorb nearly 60 per cent of the copper output and that the Anaconda Copper Mining Company does not sell any of its production except in manufactured form in this country.

INFLUENCE OF THE WAR

"Copper production has been very greatly affected by the war and its aftermath," said Mr. Kelley. "In 1913 the world's production of copper was 2,188,000,000 lb., and in 1917 the world's production had increased to 3,138,000,000 lb., owing to the artificial demands created by the war. On Jan. 1, 1919, the producers held stocks of 839,000,000 lb., and there was held by the allied governments at least another billion pounds of virgin metal and two billion pounds of available scrap accumulated during the intensive manufacture of war plants, all of which was dumped on the market during the past three years at prices below the cost of current production. The beginning of 1922 found the industry still carrying burdensome stocks, the accumulation of which had compelled the suspension of nearly all American mines in the spring of 1921. In the eleven months of 1922, for which accurate data are available, war stocks had been reduced 496,872,000 lb., or at the average rate of 45,170,000 lb. a month. Production during that time has increased to an average of 156,000,000 lb. a month, bringing the average consumption of primary copper to over 200,000,000 lb. a month, which, while it does not indicate the full measure of consumption in 1922, indicates the exhaustion of the large volume of secondary copper and a return of normal consumption, particularly in the United States. A comparison of the percentages in the price of copper with that of other basic mineral production shows that from the year 1917 to 1923, with the single exception of pig iron, all were selling at a higher level during 1921, as compared with their respective pre-war prices, than copper reached at any time excepting the year 1917. Pig iron in 1921 was selling at approximately the same increase over the pre-war price that copper reached in 1918, while copper on the contrary was selling for 20 per cent below its pre-war price.

"As a result the Anaconda Copper Mining Company, despite all the improvements made to increase the efficiency in economy and production, was obliged during the past two years to pass the payment of dividends to stockholders. In 1921 the company showed a large loss due to shutdown and the reduction of its inventories to market prices. Not only was the cost of copper during 1921 and 1922 below the pre-war level, but the cost of labor, transportation, fuel, taxes and supplies had greatly increased, and these items constitute approximately 80 per cent of the total cost of producing copper. By reason of a long-term contract with the Montana Power Company electricity was the only item of cost which remained unchanged. The rapid growth of the brass and copper manufacturing business, coupled with the continued high level of production cost in the United States, caused the Anaconda Copper Mining Company to seek an immediate supply of cheaper copper than it is possible to obtain in the United States today. Hence the purchase of the Chile Copper Company. That company, because of the character of its copper ore and other favorable circumstances, can deliver copper at a less cost than can the Anaconda Copper Mining Company, and in addition the freight rate to New York is less than one-third of the rail rate from Butte to New York, which is $16.50 a ton."

There was no indication that the consolidation would have any effect on the present price of copper, although the thought was very freely expressed that the Anaconda Copper Mining Company is now in a better position to stabilize the market. It was pointed out that the present price of copper is less than the average for the twenty-year period prior to the war.

Sign Manufacturers' Exhibit in New York City Next Week

Electrical sign and electrical advertising device manufacturers will hold an exhibition of their products in the Irving Place showroom of the New York Edison Company during the week beginning Jan. 29, it is announced by that company. In the showroom will be large signs in operation, smaller signs of the type used for window and counter display, directional signs, advertising novelties, and interesting mechanical exhibits showing the controlling apparatus which regulates the sign.

The American Brass Products Company, with general offices at 2302 Woolworth Building, New York City, announces change in its name to the United States Brass Products Company. The management and business will be continued in the same manner as in the past.

Foreign Trade Notes

PROPOSED ELECTRICAL DEVELOPMENTS IN MORAVIA, CZECHOSLOVAKIA.—Four companies, it is reported, have been organized in Moravia for the purpose of a systematic electrification of the country. A special section has been allotted to each company. The plans include utilizing the water power of the river Dyje, between Freinstyn and Znojmo. To provide the necessary funds for the project the Moravian government has decided to issue a 4½ per cent loan of 30,000,000 kronen in communal bonds of the Moravian Mortgage and Agrarian Bank.

PROPOSED WATER-POWER DEVELOPMENTS IN CZECHOSLOVAKIA. — In an effort to improve the employment situation in Czechoslovakia the Ministry of Public Works, according to *Commerce Reports*, has decided to start preliminary work on several public undertakings, including five hydraulic stations in Bohemia, one in Moravia and one in Slovakia, at an expense of 72,000,000 Czechoslovakian crowns ($2,333,000 at present exchange). In addition, seven new dams have been planned, involving a total expenditure of 609,000,000 crowns ($18,879,000), and nineteen other hydraulic stations have been proposed.

"ANNALES DES POSTES, TELEGRAPHES ET TELEPHONES" TO BE ISSUED MONTHLY.—This technical bulletin, which the French government has published for several years and which has been so far appearing bimonthly, will in the future be issued monthly, with no change in subscription price. The publication is edited by the Librairie de l'Enseignement Technique, 3 Rue Thénard, Paris.

HYDRO-ELECTRIC DEVELOPMENTS PLANNED IN IRELAND.—Following investigations into the water-power resources of the country by the Irish Commission of Inquiry, *Commerce Reports* states, the Irish Power Syndicate, Ltd., has been organized with headquarters at 28 Molesworth Street, Dublin. The company, which plans to utilize a portion of the water power of the Liffey River, has applied to the Ministry of Industry and Commerce of the Irish government for a special order to enable it to take necessary steps to acquire sites for power stations and rights of way for transmission lines. It is estimated that 8,300 hp. can be developed on the six available sites on the Liffey River.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase or agency is desired in Italy (No. 5,066) for surveying instruments and accessories and medical and surgical instruments, including the latest electrical accessories and novelties for household use.

Purchase and agency is desired in the Netherlands (No. 5,097) for wireless-telephone supplies.

An agency is desired in Sweden (No. 5,131) for all kinds of electrical articles, measuring instruments, cables and wires, electric lamps, current breakers, heating and cooking apparatus, motors, electrical apparatus for medical purposes, etc.

Purchase is desired in Spain (No. 5,149) for refrigerating machinery for small ice plants.

POSSIBLE DEMAND FOR ELECTRIC SIGNS IN SWITZERLAND.—While considerable electrical apparatus and equipment is manufactured in Switzerland there has been little local development of electric signs, according to *Commerce Reports*. The larger cities, it would seem, would offer opportunities for the installation of electric signs.

POSSIBLE DEMAND FOR PORTABLE ELECTRIC PLANTS IN BLUEFIELDS, NICARAGUA.—According to Consul William W. Heard, Bluefields, Nicaragua, Central America, there is a possible demand for portable electric plants driven by gasoline engines. The principal lighting system used in most of the stores and dwellings is the acetylene generator, which owing to climatic conditions is subject to considerable deterioration. Some of the gas plants now in use will soon have to be replaced, and it is probable that electric plants will be used.

POSSIBLE MARKET FOR ELECTRIC WATER HEATERS IN SWITZERLAND. —As electricity is plentiful and comparatively cheap, Consul Thornwell Haynes, Berne, Switzerland, states that there is seemingly in that district and throughout Switzerland a market for electric heaters which will quickly produce hot or boiling water, especially heaters that can be attached to any water faucet whereby hot or cold water can be obtained immediately, operated either on direct or alternating current.

New Apparatus and Publications

SAFETY SWITCHES. — The Mutual Electric & Machine Company, Detroit, has placed on the market a new "Bull Dog" safety motor-starting switch.

LABORATORY POTENTIOMETER. — The Queen-Gray Company, 70 West Johnson Street, Philadelphia, has brought out a laboratory potentiometer, combining the advantages of the high-resistance and low-resistance types.

ELECTRIC WASHING MACHINE.—An electric clothes washer designed particularly for use in apartment houses has been brought out by the Gillespie-Eden Corporation, Paterson, N. J.

ELECTRIC FAN.—A small fan "Aero," operated by a fractional-horsepower motor for supplying a positive circulation of air to a hot-air furnace, has been developed by the Buffalo Forge Company, 490 Broadway, Buffalo, N. Y.

ELECTRIC FAN.—A 10-in. fan finished in ivory-tinted enamel with nickel-plated trimmings has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. An illustrated booklet entitled "What Fans Are For," which shows the many ways in which a fan can be used, has been issued by the company.

MAGNETOS.—The American Bosch Magneto Corporation, Springfield, Mass., has developed a new type of "Bosch" magneto, known as type "AT." This instrument is waterproof and made for use with large four-cylinder and six-cylinder engines.

BRUSH EQUIPMENT. — The National Carbon Company, Inc., Thompson Avenue and Orton Street, Long Island City, N. Y., has issued a supplement to its catalog No. 37, describing its electrographitic brush—259—for the direct-current side of synchronous converters, and the Ringsdorff ET-10 metal graphite brush for the alternating-current side.

VARIABLE-SPEED TRANSMISSION.—"The Driscoll Variable Speed Transmission" is the title of a booklet distributed by the Driscoll Transmission Corporation, 416 West Thirty-third Street, New York City, describing the "Driscoll" device for control and transmission of mechanical energy.

CONDENSERS. — The Elliott Company, Jeannette, Pa., has published a new catalog, C-L, covering the Elliott-Ehrhart condensers, in jet, barometric and surface types. It also describes the Elliott-Ehrhart air ejectors, types "A," "B" and "C," and other products of the company.

New Incorporations

THE SOUTH MISSOURI POWER COMPANY, Greenfield, Mo., has been incorporated with a capital stock of $100,000 by C. L. Ward, Buford Adams and E. Nelson. The company proposes to construct and operate electric light, water, power and heating plants and distributing systems, etc.

THE MARSHFIELD (MO.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by T. F. Bowdern, L. A. Reynolds and others. The company is capitalized at $25,000 and proposes to operate an electric light plant.

THE VALLEY ELECTRIC & ICE COMPANY, San Antonio, Tex., has been chartered with a capital stock of $200,000 by R. W. Morrison, A. C. Prucha and H. C. Leohr.

THE GRAFTON (VT.) LIGHT & POWER COMPANY has been incorporated by Justin C. Tay, Grafton; Edward L. Walker, Bellows Falls, and Fred M. Prouty, Grafton. The company is capitalized at $10,000 and proposes to erect a transmission line from Saxtons River to Grafton and to distribute electricity, and also to deal in electrical supplies.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS. — The Supply Officer, Boston Navy Yard, will purchase 1,100 hand flashlights. (N.S.A.F.Req. 212.)

HOLYOKE, MASS. — Extensions to the municipal electric plant, involving an expenditure of about $400,000, are under consideration by the Municipal Gas and Electric Department. John J. Kirkpatrick is manager.

WORCESTER, MASS.—The New England Power Company plans to erect a high-tension transmission line from Sherman, Vt., through Greenfield to Millbury, a distance of 75 miles, where a station will be erected. It is also proposed to build a transmission line from Sherman to Pittsfield. The New England company is building a large hydro-electric plant on the Deerfield River, near Whitingham, Vt.

NEW MILFORD, CONN. — Work has started on the foundation for the initial units of the proposed new local electric generating plant of the Connecticut Light & Power Company, Waterbury, to cost about $750,000.

SEYMOUR, CONN. — Preparations are being made by the Connecticut Light & Power Company, Waterbury, for improvements in the Seymour district, to include the rebuilding of the local substation, installation of new switching equipment and rearrangement of the distribution lines in Seymour, and also the erection of an additional transmission line between Naugatuck and Seymour and reconstruction of the existing line. The cost of the entire work is estimated at about $30,000. W. T. Pratt, Naugatuck, is district manager.

Middle Atlantic States

BUFFALO, N. Y.—Plans are being prepared for the installation of electric lighting fixtures at the Broadway Auditorium, to cost about $30,000. The work will be done by the municipality, with Commissioner Meahl in charge.

CHENANGO BRIDGE, N. Y.—An electrically operated pumping plant will be installed in connection with local waterworks to be built by the County Board of Supervisors, Binghamton, to cost about $115,000.

COEYMANS, N. Y.—The Atlantic Light & Power Company has petitioned the Public Service Commission for permission to extend its system to the town of Bethlehem for the purpose of supplying electricity to the railroad yards of the New York Central system.

DEFERIET, N. Y.—The St. Regis Paper Company is planning to erect a wood-grinding plant at Deferiet, which will be equipped with electrically driven machinery. Power requirements, it is stated, will be about 15,000 hp.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company until Feb. 2 for railway motors and multiple-unit control equipment (Serial contract No. 3-1923). C. S. White, 466 Lexington Avenue, is purchasing agent.

PHILADELPHIA, N. Y.—At a recent election it was voted to install meters throughout the entire municipal electric lighting system in the town and surrounding territory. Warner Hubbard is manager of the municipal plant.

ROCHESTER, N. Y.—Extensions will be made to power station No. 3 of the Rochester Gas & Electric Corporation to provide space for switching apparatus and a new electric boiler. The cost is estimated at about $400,000.

TROY, N. Y.—The Rensselaer Polytechnic Institute will soon ask for bids for the erection of a three-story addition to the electrical laboratory, 50 ft. x 70 ft. Lawlor & Haase, 15 West Thirty-eighth Street, New York, are architects.

WATERTOWN, N. Y.—The Power Corporation of New York, Inc., has issued $1,000,000 in capital stock, part of the proceeds to be used for extensions and improve-

ments. The company is affiliated with the Northern New York Utilities, Inc.

WEST HENRIETTA, N. Y.—The Rochester (N. Y.) Gas & Electric Company has petitioned the Public Service Commission for permission to extend its lighting and power system into this town.

BRANCHVILLE, N. J.—The Branchville Electric Power, Water & Lighting Company has been ordered by the Board of Public Utility Commissioners to make improvements to its system. Electric meters will be installed for all consumers, replacing the present flat-rate system. Charles H. Crisman is owner.

BURLINGTON, N. J.—The Public Service Corporation plans to increase the output of its plant to 37,500 kw.

CAMDEN, N. J. — The Public Service Electric Company has contracted with the Philadelphia Electric Company for power for its South Jersey system. Three submarine cables will be laid under the Delaware River, with line connection at Camden. The Public Service company has plans for a generating plant addition, to cost about $1,000,000, to be carried out in connection with an improvement program estimated at $25,000,000.

MORRISTOWN, N. J.—The property of the Morris & Somerset Electric Company has been acquired by A. E. Fitkin & Company, 141 Broadway, New York. Extensions and improvements are contemplated.

STEWARTSVILLE, N. J. — The Greenwich Township Committee is preparing plans for the installation of a local lighting system.

WOODBURY, N. J.—The Woodbury Ice & Power Company plans to build a one-story power plant and an ice factory.

CHAMBERSBURG, PA.—D. P. Minick will build a power house in connection with proposed ice and cold-storage plant at 147 East Queen Street. John Crowe, Hartman Building, York, Pa., is architect and engineer.

DELTA, PA.—The properties of the Delta Electric Light Company and the Delta Water Power Company have been acquired by the Susquehanna Power Company, which proposes to build a dam across the Susquehanna River at Conowingo, Md., to furnish power for a large electric plant. J. A. Schriever, Bel Air, Md., is interested in the Susquehanna company.

HYNDMAN, PA.—The property of the Hyndman Electric Light, Heat & Power Company has been acquired by the American Water Works & Electric Company, 50 Broad Street, New York. It has also purchased the Deal Power Company, Cooks Mills, near Hyndman. Extensions and improvements will be made in the system.

PITTSBURGH, PA. — Bids will be received by the Board of Education, 1326 Fulton Building, until Feb. 1 for the installation of electrical equipment at the Peabody high school addition, including motors, mechanical fans, etc. George W. Gerwig is secretary.

PITTSBURGH, PA.—Receivers for the Pittsburgh Railways Company have been authorized to make improvements, including the installation of new equipment at substations, feeder lines, and cables, etc., to cost $211,300. W. D. George, S. L. Tone and C. A. Fagan are receivers.

SALISBURY, MD. — Plans are being arranged for the installation of an ornamental street-lighting system on Division and Main Streets, in the business district. F. H. Dryden, city engineer.

NEW WINDSOR, MD. — Improvements will be made in the local municipal power plant and system, including the installation of additional equipment.

BLUEFIELD, W. VA.—The Appalachian Power Company contemplates the installation of an additional generating unit at its steam-power station at Glenlyn, Va., to cost about $1,800,000. The work will include an addition to power house and installation of one 20,000-kw. steam turbine and four boilers with auxiliary equipment, etc. Viele, Blackwell & Buck, 49 Wall Street, New York City, are engineers and contractors.

KENOVA, W. VA. — The Consolidated Light, Heat & Power Company, Huntington, will make extensions in its local power plant, increasing the capacity by about 15,000 kw.

NORFOLK, VA.—Bids will be received by the Bureau of Supplies and Accounts, Washington, D. C., until Feb. 6 for busbar supports, cable terminals and cable racks (Schedule 444); also for 1,200 ft. telephone cable and miscellaneous single copper cable (Schedule 445).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until Jan. 29 for 50 switch panels (Circular 23-111).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Feb. 8 for 350 telephone transmitters and mouthpieces (Circular P.R. 13145-B-99 CP).

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon call for bids for the installation of electric traveling cranes at the Puget Sound Navy Yard under Specification 4,755.

WASHINGTON, D. C. — Arrangements are being made by the United States Shipping Board, Washington, for an appropriation of from $5,000,000 to $6,000,000 for remodeling twenty-three post-war American passenger vessels and a number of merchant steamers. The work will include the installation of new electric generators, electric lighting sets, engine and pumping machinery, condensers, etc.

North Central States

DETROIT, MICH.—The Père Marquette Railroad Company, Union Station, contemplates building a power house in connection with its proposed engine terminal at West Jefferson and Twenty-first Streets, to cost about $1,000,000.

CLEVELAND, OHIO.—The installation of two additional 1,400-hp. boilers in the municipal electric light plant this year is under consideration. The cost is estimated at about $250,000. C. G. Beckwith is superintendent of the lighting department.

COVINGTON, OHIO. — The Buckeye Light & Power Company is negotiating for the purchase of the property of the Stillwater Valley Electric Company, West Milton. Extensions and improvements will be made.

MARTINS FERRY, OHIO. — Plans are being prepared for construction of a pumping station to be equipped with two 4,000,000-gal. pumps, ash-handling equipment and electric generating station, to cost about $450,000. The J. N. Chester Engineering Company, Union Building, Pittsburgh, is engineer.

PHILO, OHIO.—The Ohio Power Company will soon commence work on its proposed local generating plant. Two generating units each of 35,000 kw. will be installed.

TIFFIN, OHIO.—An ordinance has been passed authorizing the present overhead wires to be placed in underground conduits.

CROWN POINT, IND.—A power house will be built in connection with the proposed County Tuberculosis Sanitarium, about 2 miles from the city, to cost about $350,000. Karl D. Norris, Calumet Building, East Chicago, Ind., is architect.

FORT WAYNE, IND.—Bids will be received by the Board of Public Works until Feb. 12 for one 3,000-kw. turbo-generator, switchboard apparatus and one surface condenser.

LOGANSPORT, IND. — The Northern Indiana Power Company, Kokomo, which recently acquired the property of the Logansport Utilities Company, has started work on the erection of a new power plant, to cost about $500,000. The equipment will include two 1,000-kw. turbines, three 565-hp. boilers, pump house and filter plant, etc.

PENDLETON, IND.—A power plant will be installed at the new Indiana Reformatory to be built here, to cost, with equipment, $175,000. A distributing system will be erected at a cost of $75,000. The committee, composed of Joseph E. Henning, John O'Neil and J. W. Nash, Indianapolis, has applied for an appropriation for this work.

CHICAGO, ILL. — A one-story power plant will be erected at the new home to be built on Ridge Avenue by the Guardian Angel, German Catholic Orphan Society, 2001 Devon Avenue, at a cost of $250,000. Herman J. Gaul, 111 West Washington Street, is architect.

NEW BADEN, ILL. — The Southern Illinois Light & Power Company, Hillsboro, has acquired the local municipal plant and will furnish service in the future from its 33,000-volt transmission line. The local power plant will be discontinued.

WAUKEGAN, ILL. — Plans have been completed by the Public Service Company of Northern Illinois, 72 Adams Street, Chicago, for the initial unit of its proposed new local power plant, to cost about $3,000,000.

ALGOMA, WIS. — The City Council is considering the question of equipping the waterworks pumping station with electrically driven pumps.

GREEN BAY, WIS. — The Wisconsin Public Service Commission contemplates extending its transmission line from High Falls to Wausaukee, Amberg and Middle Inlet, a distance of about 25 miles. The cost is estimated at about $42,000.

GREEN BAY, WIS. — Plans are being prepared by the Wisconsin Public Service Corporation for extensions to its plants in Oshkosh, Sheboygan and Marinette, Wis., and in Michigan. It has recently acquired a power site at Chaldron Falls on the Peshtigo River where an 11,000-hp. plant will be erected, at a cost of $1,000,000.

STEVENS POINT, WIS.—The Consolidated Water Power & Paper Company, Wisconsin Rapids, is considering an additional water-power development in Stevens Point.

OSKALOOSA, IOWA.—The City Council is preparing plans for a municipal hydro-electric plant at Harvey, to cost about $375,000. Burns & McDonald, Interstate Building, Kansas City, Mo., are engineers.

JASPER, MO. — The proposal to issue $32,000 in bonds for the construction of a municipal electric light and power plant will be submitted to the voters.

SPICKARDSVILLE, MO. — The Trenton (Mo.) Gas & Electric Company has been granted a franchise to erect a transmission line from Trenton to Spickardsville and install a distributing system here. A loan of $15,000, it is said, is available.

TRENTON, MO.—The proposed extensions and improvements to the municipal waterworks include the installation of electrically operated pumps. The cost is estimated at about $175,000. The Burns & McDonnell Engineering Company, Interstate Building, Kansas City, Mo., is engineer.

Southern States

HICKORY, N. C.—Water rights on the Catawba River below Horseford Shoals have been acquired by Joseph B. Elliott, which will be utilized for a hydro-electric development.

MORGANTOWN, N. C. — Improvements will be made to the street-lighting system, to cost about $9,000.

SPARTANBURG, S. C. — The Pacific Mills Company, Lawrence, Mass., will build a power house in connection with its proposed local textile plant, to cost about $1,500,000.

MILLTOWN, GA. — The Lanier County Power Company, recently organized, plans to build a power plant at the foot of Lake Irma, to cost about $300,000. The company is headed by F. E. Hatch.

ANNA MARIA, FLA.—H. W. Ralston contemplates the installation of an electric plant on Anna Maria Beach.

ARCADIA, FLA.—Plans are under way for the construction of a municipal light and power plant in Arcadia.

McINTOSH, FLA.—The McIntosh Utilities Company is planning to establish an electric light plant in McIntosh. S. H. Gaitskill is president.

BIRMINGHAM, ALA. — The Alabama Power Company plans to erect a substation in Leeds at a cost of $1,500,000 to distribute energy generated at the Mitchell Dam and Lock 12 to the Birmingham district. A 50-mile, 110,000-volt transmission line will be erected from Lock 12 to the Leeds station. Another transmission line will connect Mitchell Dam with Lock 12 and the Leeds substation with Birmingham.

FLORENCE, ALA.—Bids will be received by the United States Engineer Office until Feb. 12 for one electric 937-kva. generator, 937.5 kva., with exciter, for use at Sheffield, Ala.

MOBILE, ALA. — The Great Southern Roofing Corporation, recently organized, will build a power house in connection with its proposed local factory. William D. Martin is secretary and treasurer.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company contemplates extensions and improvements during 1923, including the construction of a 120,000-volt steel-tower transmission line to Lindale, connecting with the system of the Georgia Railway & Power Company. The cost of the work is estimated at about $2,450,000.

GULFPORT, MISS. — The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon take bids for the installation of electric lighting systems in the buildings to be erected at the veterans' hospital, with power circuits and telephone conduit, power-house equipment, piping, etc. (Specification 4774).

PARAGOULD, ARK.—The City Council has granted a franchise to R. W. Meriwether and H. W. Woosley to construct and operate an electric light and power system.

SMACKOVER, ARK.—The Pan-American Petroleum & Transport Company, 120 Broadway, New York City, has acquired 120 acres in the new Smackover (Ark.) oil field and plans to build at once a storage and distributing plant, consisting of twenty-two steel tanks of 80,000 barrels each, power house, pumping plant, machine shop and other buildings. Edward L. Doheny is chairman of the board.

BOGALUSA, LA.—The Bogalusa Power Company will build an electric power plant in connection with extensions to its mill, to cost about $1,000,000. James L. Carey, 208 North Laramie Avenue, Chicago, is engineer.

RAYNE, LA.—Bonds to the amount of $125,000 have been voted by Acadia Parish for extensions to lighting and water systems. J. B. McCrary & Company, Third National Bank Building, Atlanta, Ga., are engineers.

LAHOMA, OKLA.—An electric transmission line will be erected from Drummond to Lahoma, about 8 miles, for local service, to cost about $12,000.

AMARILLO, TEX.—The installation of electrically operating pumping machinery at the municipal waterworks is under consideration.

BRECKENRIDGE, TEX. — The Great Texas Oil & Refining Company will install electric power equipment in connection with a local refinery, now in course of construction, to cost about $1,200,000.

HOUSTON, TEX.—The South Texas Cold Storage & Warehouse Company will install electric power equipment in its proposed ice and cold-storage plant near the Main Street viaduct, to cost about $1,000,000.

Pacific and Mountain States

EVERETT, WASH.—The Delta Electric & Water Company contemplates erecting transmission and distributing lines in different parts of Snohomish County. A franchise has been asked.

KETTLE FALLS, WASH.—The Washington Water Power Company, Spokane, contemplates building a hydro-electric plant at Kettle Falls, to cost about $3,000,000.

LOS ANGELES, CAL.—An ordinance has been passed authorizing the installation of ornamental lamps on Sixth Street and on Palos Verdes Street in the San Pedro Harbor district.

PASADENA, CAL.—Bids will be received by the City Clerk until Feb. 9 for one 10,000-kw., 2,400-volt, steam turbo-generator unit, one jet condenser and one surface condenser and circulating pump for the Municipal Light Department.

REDLANDS, CAL.—The Southern California Edison Company will install an ornamental lighting system to replace present lamps on all city streets.

SACRAMENTO, CAL.—Plans are being prepared for a municipal hydro-electric plant at Silver Creek. Albert Givan is city engineer.

SAN PEDRO, CAL.—The installation of new street lamps on Pacific Avenue is under consideration.

SAN YSIDRO, CAL.—Plans are being considered for the establishment of a new lighting district in this section. J. M. McLees, clerk San Diego County, San Diego, is in charge.

TAFT, CAL. — Plans for the proposed ornamental system in the business district provide for seventy-one lamp standards. Bids will soon be called.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company has secured a site at Bruce's Eddy, where it proposes to build a hydro-electric plant.

PEACH SPRINGS, ARIZ.—The Colorado River Engineering & Development Company has been granted permission by the State Water Commission to build a hydro-electric plant on the Colorado River on Diamond Creek, near Peach Springs. The plant will have an ultimate capacity of 200,000 hp. and will cost about $25,000,000. James B. Girard, Phoenix, is engineer.

PHOENIX, ARIZ.—Bids will be received by the Salt River Valley Water Users' Association, Phoenix, until Feb. 5 for one 10,000-hp. turbine, one 7,500-kva. generator, 25 cycles, 2,300 volts, for installation in power house at the Roosevelt dam. The cost is estimated at from $130,000 to $140,000. H. Lawson is superintendent of power.

DENVER, COL.—Arrangements are being made by the Denver Gas & Electric Company and the Western Light & Power Company, Boulder, both controlled by the Cities Service Company, for the construction of a large steam-driven electric generating plant about 4 miles south of Boulder. Four million dollars will be spent at once on a development, the initial installation in which will generate 12,000 hp. The present plans provide for a development of 120,000 hp., to cost with transmission system about $12,000,000.

DOVE CREEK, COL.—An electric lighting plant, it is said, will be installed in the new hotel to be erected by George E. Haney. It will be of sufficient size to furnish service for the entire community.

LAMAR, COL.—Plans for the proposed ornamental lighting system call for eighty standards. Contract for cable and regulators have been awarded. Bids for standards, tops and other equipment will soon be called for. J. E. Todd is superintendent of the municipal electric plant.

FARMINGTON, N. M. — The Western Colorado Power Company, Durango, it is understood, contemplates erecting a new, high-tension transmission line from Denver to Farmington.

LOVELAND, N. M.—A movement has been started by the city officials for rebuilding the local electric light plant. Service has been discontinued for several months.

Canada

BURQUITLAM, B. C.—The Council has asked the British Columbia Electric Railway Company, Vancouver, to submit an estimate of cost for the installation of a lighting service in Burquitlam.

BRANDON, MAN.—The Rennie Engineering Company, Winnipeg, has submitted a proposition to the City Council for the installation of a municipal electric power plant, to cost about $850,000. The proposal calls for gas-engine-driven generators.

ST. JOHN, N. B.—Preliminary plans have been completed for the proposed municipal Hydro substation. Tenders for construction of same, it is understood, will soon be called for.

PORT CREDIT, ONT.—Improvements to the municipal electric lighting system are under consideration by the Town Council.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 2, 1923)

1,440,952. DYNAMO-ELECTRIC MACHINE; V. G. Apple, Dayton, Ohio. App. filed June 11, 1920. Windings impregnated with phenolic condensation product while in liquid state.

1,441,002. MEANS OF GROUNDING ELECTRICAL PILOTING CABLES; H. W. Kitchin, Washington, D. C. App. filed Jan. 29, 1921. By turning back on cable and electrically connecting conductor with armor.

1,441,025. CONDUCTOR-BAR HOLDER; H. F. Raab, Johnstown, Pa. App. filed Sept. 20, 1922. Means for holding conductors for electric cranes.

1,441,029. TRANSMITTER FOR TELEPHONY; H. J. Round, London, England. App. filed March 31, 1920. Transmitter used with thermionic generators in which direct current causes continuous waves to be generated while alternating current causes amplitude of these waves to be varied.

1,441,037. PROCESS OF BAKING CARBON ELECTRODES; C. W. Söderberg, Christiania, Norway. App. filed Dec. 4, 1917.

1,441,054. OUTLET BOX; J. Barry, Brooklyn, N. Y. App. filed Oct. 12, 1920.

1,441,087. WIRING SYSTEM; J. W. Hill, Salt Lake City, Utah. App. filed April 6, 1921. Transmitting circuit of wireless telegraphy.

1,441,131. ELECTRICALLY HEATED KETTLE AND THE LIKE; W. W. Soutter, Birmingham, England. App. filed Dec. 22, 1921.

1,441,150. INCANDESCENT ELECTRIC LAMP; W. D. Hawley, Syracuse, N. Y. App. filed June 10, 1920.

1,441,160. DENTAL X-RAY PACKAGE; Rochester, N. Y. App. filed May 15, 1920. Wrapper for film.

1,441,193. ELECTRIC CIRCUIT MAKING AND BREAKING DEVICE; C. W. Wyman, Claremont, N. H. App. filed Sept. 1, 1916. To prevent explosions where circuit is broken in gaseous regions.

(Issued Jan. 9, 1923)

15,524 and 15,525 (reissue). SYSTEM OF CONTROL; N. W. Storer, Pittsburgh, Pa. App. filed April 12, 1921. Successive groupings of railway motors form a non-geometrical series to provide several speed ranges.

1,441,200. COUPLING; W. G. Allan, Toronto, Ontario, Can. App. filed Feb. 3, 1920. Insulated coupling for metal tubes entering electrolytic cells.

1,441,233. LOW-VOLTAGE ATTACHMENT; M. McCright, Cincinnati, Ohio. App. filed Oct. 30, 1919. Pilot brush on direct-current commutator for charging batteries direct.

1,441,247. COMBINED LAMP AND BELL; C. Shiono, Los Angeles, Cal. App. filed Sept. 20, 1921. For bicycles and motorcycles.

1,441,270. TRANSMISSION SYSTEM; L. Espenschied, Hollis, N. Y. App. filed Sept. 26, 1919. Several messages sent over telephone wires by using different carrier frequencies.

1,441,289. CURRENT-COLLECTING HEAD; E. S. Lincoln, Mansfield, Ohio. App. filed Jan. 7, 1922. Means for conducting a heavy current from one to the other of two relatively moving parts.

1,441,310. MOTOR CONTROL; W. G. Thomas, New York, N. Y. App. filed April 21, 1920. Method of electrically locking rotors of two alternating-current motors.

1,441,398. ELECTRIC SWITCH; W. A. Chryst, Dayton, Ohio. App. filed May 22, 1920. Controls automobile ignition apparatus and lighting system.

1,441,399. ELECTRICAL RESISTANCE; W. Clark, London, England. App. filed April 3, 1921. Wheatstone bridge with visual indication of resistance in each branch.

1,441,408. METHOD OF AND APPARATUS FOR ELECTROLYZING LIQUID; H. H. Dow, T. Griswold, Jr., and E. O. Barstow, Midland, Mich. App. filed Aug. 12, 1915. Method for equalizing height of liquid in cells.

1,441,421. SEWING-MACHINE-MOTOR CONTROL; F. F. Hillix, Cleveland, Ohio. App. filed Sept. 14, 1921. Operated by lateral movement of foot or knee.

1,441,422. SEWING-MACHINE-MOTOR CONTROL; F. F. Hillix, Cleveland, Ohio. App. filed March 30, 1922. Controlled by lateral movement of foot or knee.

1,441,426. ELECTRICAL RECTIFIER AND POLE CHANGER; W. Kaisling, Chicago, Ill. App. filed April 12, 1918. Automatic auxiliary telephone-ringing equipment operated from batteries.

1,441,427. POLARITY INDICATOR; W. Kaisling, Chicago, Ill. App. filed Aug. 7, 1918. To show whether storage battery is charging or discharging.

1,441,429. ALTERNATING-CURRENT INDUCTION MOTOR; J. F. Kelly, Troy, N. Y. App. filed July 21, 1916. Two-phase motor can also operate as single-phase split-type motor.

1,441,436. JIG FOR USE IN ASSEMBLING AND ELECTRICALLY WELDING TOGETHER THE PARTS OF AUTOMOBILE BODIES AND OTHER STRUCTURES; J. Ledwinka, Philadelphia, Pa. App. filed March 15, 1921.

1,441,443. ELECTRODE CLAMPING DEVICE FOR ELECTRIC WELDING MACHINES; J. W. Meadowcroft, Philadelphia, Pa. App. filed Aug. 16, 1921. Device for releasably locking or clamping electrodes in machine.

1,441,451. IGNITION SYSTEM; W. W. Riedel, Dayton, Ohio. App. filed Jan. 8, 1921. Electrically ignited fuel burner for combustion engines.

1,441,460. SELF-COOLED ELECTRIC MOTOR; A. G. Sutcliffe, Chicago, Ill. App. filed Jan. 21, 1922. For motors used on direct-driven fans and blowers.

1,441,479. PROCESS FOR MAKING AN ALLOYING ALLOY; W. Bennett, Wellington, N. Z. App. filed Sept. 8, 1922. Made directly from the ores.

1,441,482. SPEED CONTROL OF DIRECT-CURRENT MOTORS; F. A. Byles, Schenectady, N. Y. App. filed Aug. 30, 1920. Vibratory regulator holds speed of motor constant.

1,441,500. TROLLEY RETRIEVER; G. E. Harpham, Los Angeles, Cal. App. filed May 16, 1918. Mechanism for lowering pole when connducting wheel leaves feed wire.

1,441,532. ELECTRICAL APPARATUS; P. R. Fortin, Schenectady, N. Y. App. filed July 1, 1920. Devices for varying the inductance of radio circuits.

1,441,546. REGULATION OF ELECTRIC CIRCUITS; L. W. Thompson, Schenectady, N. Y. App. filed Aug. 27, 1919. Voltage regulator for electric machine.

1,441,567. ELECTRODE; C. G. Fink, Yonkers, N. Y. App. filed Feb. 18, 1921. Insoluble anode for electrodeposition of copper from electrolytes containing chlorides and nitrates.

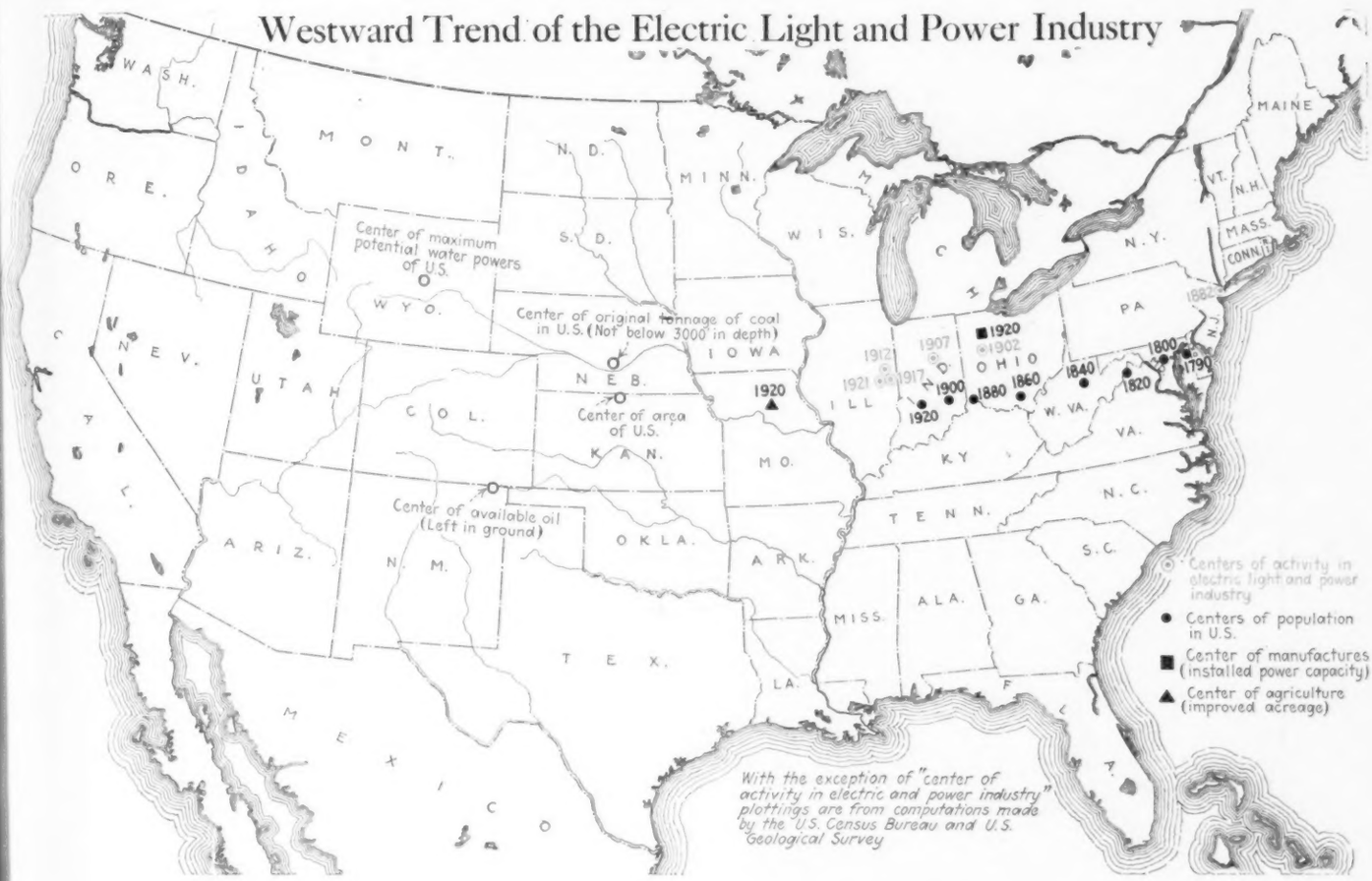
1,441,568. ELECTRODEPOSITION OF COPPER; C. G. Fink, Yonkers, N. Y. App. filed March 10, 1921. From copper sulphate electrolytes containing iron and copper sulphate.

1,441,610. ELECTRIC HEATING AND COOKING; W. B. Topp, Melbourne, Victoria, Australia. App. filed Jan. 16, 1922. Electrodes in water vaporize liquid to heat receptacle.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Westward Trend of the Electric Light and Power Industry



Location of Center of Activity in Electric Light and Power Industry

(Based on Kw.-hr. generated)

Computed by ELECTRICAL WORLD

Year	*Latitude*	*Longitude*
1902	40° 27′	84° 29′
1907	40° 27′	86° 01′
1912	40° 20′	88° 01′
1917	40° 12′	87° 53′
1920	40° 18′	87° 52′
1921	40° 08′	88° 08′

Location of Center of Population in United States

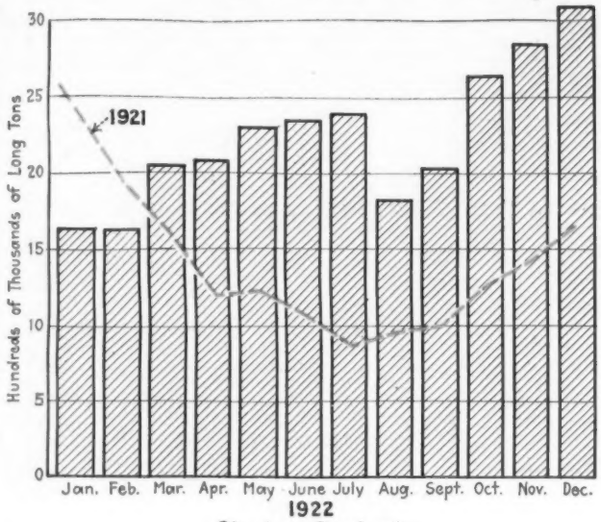
Computed by U. S. Census Bureau

Year	*Latitude*	*Longitude*
1790	39° 15′	76° 11′
1800	39° 16′	76° 57′
1820	39° 06′	78° 33′
1840	39° 02′	80° 18′
1860	39° 01′	82° 48′
1880	39° 04′	84° 40′
1900	39° 10′	85° 48′
1920	39° 10′	86° 43′

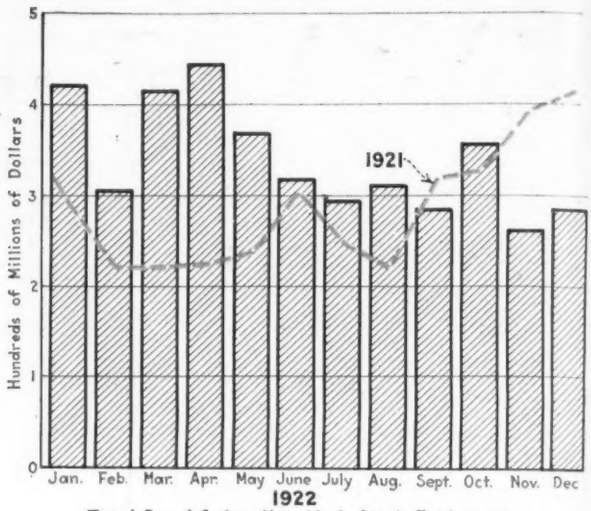
"Go West, Young Man"

WHEN Horace Greeley in a personal letter advised a young friend that the West offered him the largest opportunities for success, he foretold the westward trend of American industry. Each decade has witnessed the centers of our population, agriculture and manufactures move further and further westward from their point of origin, the borders of the Atlantic. It is but natural, therefore, that the center of activity in the central-station industry should also follow this general trend. But this industry has exhibited a much greater acceleration in movement than the population or the other primary industries of the country. Originating in New York City in 1882, the center of activity in the central-station industry quickly jumped westward. In 1907 it was in Indiana, and in 1921 it had advanced into Illinois and was in Champaign County, about 3 miles northwest of Urbana, or 116 miles south of Chicago. This center is at present many miles west of the center of population and manufactures, an excellent testimony to the rapid electrical development and optimism of the commonwealths of the Far West.

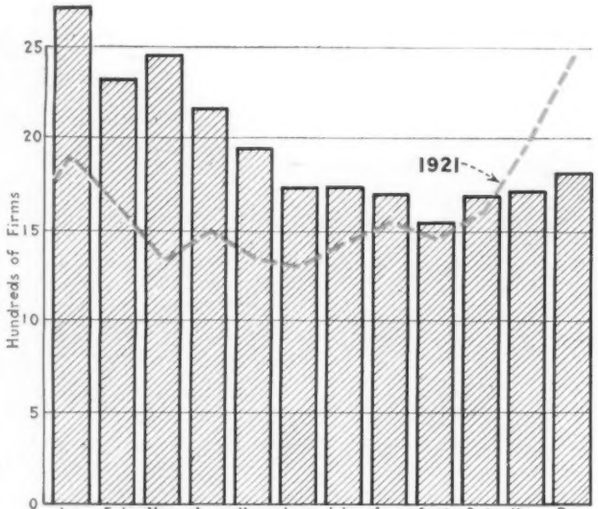
How the Primary Industries are Trending



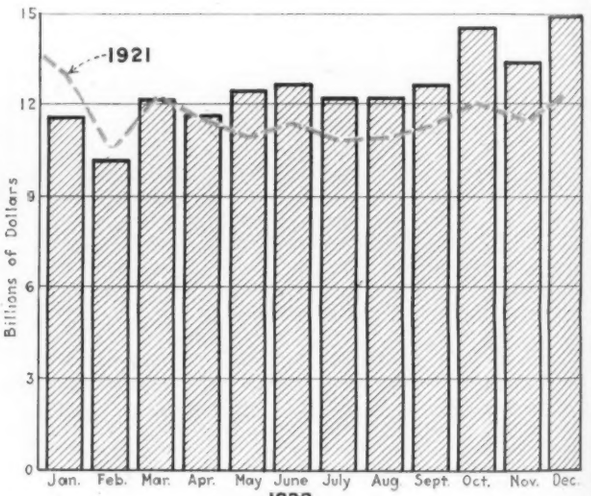
Pig-Iron Production



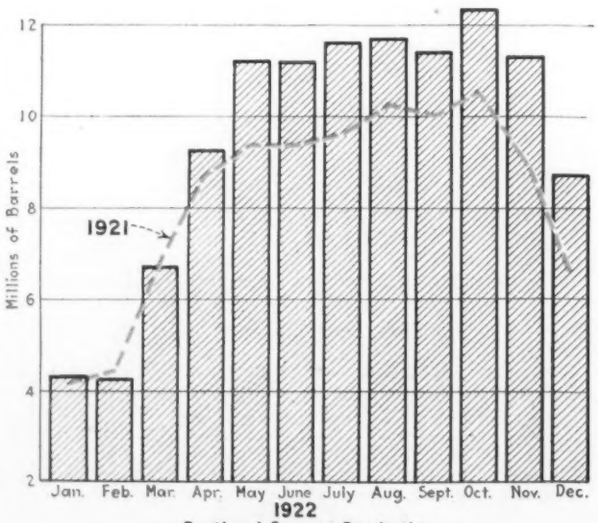
Total Bond Sales, New York Stock Exchange



Business Failures



Bank Clearings
(Outside of New York City)



Portland Cement Production

Pig-Iron Production Indicates Prosperity Ahead

PIG-IRON production, which is considered by many prominent economists and statisticians to be a fair barometer of general business conditions, showed a remarkable recovery during 1922. The iron and steel industry was from 60 to 70 per cent more active than in 1921, but was less active than in the boom year of 1920. Last December, however, pig-iron production touched the high point of the year and appeared to be well on its way to new high figures for the industry. Unfilled orders of the United States Steel Corporation rose about 60 per cent during 1922.

The number of business failures during the past year was 27 per cent larger than 1921 and exceeded any previous year since 1915. The amount of defaulted liabilities exceeded the large defaults in 1921 by 5 per cent. But it is encouraging to note that the number of failures steadily declined during the year and during November and December was less than those reported for the same months of 1921.